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King George the Sixth

WITH historic ceremonial and pageantry and to the accompaniment of the pulsation of millions of loyal hearts in the Motherland and Overseas, the accession of King George the Sixth was proclaimed on Saturday, December the twelfth. On the previous day King Edward the Eighth had signed the Instrument of Abdication and now the Duke of York, as we have known him so well for between sixteen and seventeen years, has shouldered the burden, becoming King of Great Britain and Ireland and the British Dominions Beyond the Seas, Defender of the Faith, Emperor of India.

We feel that we are giving expression to the sentiments of the entire electrical profession and industry when we assure King George and Queen Elizabeth of complete loyalty and genuine sympathy with them in the position of immense influence and responsibility to which they have been called.

Bertram Park

Of the King himself much could be written regarding the various ways in which his keen interest in the daily life of his subjects at Home and Overseas has been demonstrated. His active presidency of the Industrial Welfare Society during a long period gave him a firm conviction that nothing was more important to the security and prosperity of the Empire than work initiated and inspired by this organisation; it also led to the holding of annual industrial camps, where large numbers of public schoolboys and lads from the industries fraternised. He toured the industrial areas, gaining close touch with the everyday conditions of the workers.

In his early years at Cambridge theoretical physics and mechanical science were amongst the subjects in which he was specially interested, while later on his enthusiasm for wireless took shape in a workshop where many devices were tested as they became available. His interest in these matters, his war-time service with the Navy and the Air Force, have been of assistance to him in his investigations of manifold industries in which science and engineering rank so prominently. His Majesty is an honorary member of the Institution of Civil Engineers.

The visits which King George and Queen Elizabeth paid to the Colonies and Dominions provided opportunities for close study of Empire problems, while his presidency of the British Empire Exhibition held at Wembley in 1924 and his keen interest in successive British Industries Fairs held in London and Birmingham have focused attention on inter-colonial trade relations. Other great exhibitions at which our new Monarch and his gracious Queen have represented us as a people have been held in Paris and in Brussels.

Here we can only briefly outline some of the qualifications for understanding leadership with which King George ascends the Throne, adding the conviction that his subjects everywhere look forward hopefully to long years of peace and prosperity under his beneficent reign.

The Coronation

THE announcement that there is not to be any change of date for the Coronation has brought relief to many trades. Manufacturers and others producing electrical devices of various kinds for illumination and decorative schemes, internal and external, had, of course, to prepare their plans as long as possible in advance of the event, so that contractors, electricity supply authorities and traders might be prepared to execute orders promptly. Inquiries made by us during the past few months have shown an earlier readiness than was noticeable on the occasion of the Jubilee celebrations of last year, and, after the slowing down of the last week or two, efforts from now onward will be redoubled. It is unfortunate that changes in adopted and circulated designs will now be inevitable in a goodly number of cases, but doubtless the difficulty will stimulate ingenuity, while the additional requirements consequent upon the popularity of Queen Elizabeth and the Royal children will mean the production of many new and attractive pieces of design work. And, beyond all this, there will be a general determination to see that the extent and beauty of the displays everywhere shall gain, rather than suffer, through the change of personalities.

The Works Electrical Engineer

WITH to-day's unparalleled expansion and modernisation of the heavy industries comes, in many cases for the first time, a keener appreciation of the increasingly vital part electricity is playing in not merely the operation of plant, but more directly in production. Because of the fundamental character of its production there is no better illustration of this than the iron and steel industry. In its modern form this industry cannot do without electricity, and the future of the iron and steel industry is dependent to a very large extent on the electrical engineer's skill. Our description this week of the electrical equipment and its applications at the new Cardiff works of Guest Keen Baldwins Iron & Steel Co., Ltd., will emphasise the point. Moreover the future holds such outstanding developments as the works to be built at Ebbw Vale and equipped with, roughly, 100,000 kW of electrical plant, including the first wide strip mill to be employed in this country, for use in the production of 600,000 tons of steel per annum. Obviously the operation of such plant must be in the hands of responsible men, and the appreciation referred to should do much to raise to its proper level the status of the works electrical engineer.

Industrial Achievements

IT is seldom that we see during a single works visit so many outstanding new electrical developments as we did at the new Guest Keen Baldwins works at Cardiff. No electrical engineer could watch the large single-armature (75 tons) 20,000-h.p. motor reversing under load every few seconds without a deep sense of pride. The pull on the windings is such as to demand precision in workshop assembly unthought of a few years ago. The extraordinary performance of the bloom shears in starting, accelerating and stopping weighty blooms five times a minute represents something of a record in electric control—just for the moment. Another application of Ward-Leonard speed regulation is to the screw-down motors of the blooming mill—again with an increase of speed and consequent output. The supply man, too, should have an eye on the electric drive for the tilting furnaces, for it opens up another large development field.

Reorganisation Again

ALTHOUGH it is true that, upon the whole, local authority electricity supply is cheaper than that of the companies, we feel that the criticism of the companies made by Mr. S. E. Britton (Chester) in a recent report on distribution reorganisation is perhaps a little sweeping. He implies that the electricity which they supply is dearer because they aim at profit rather than widespread service. No doubt there are still some of the smaller companies running on these lines, but most of the private concerns display an enlightened self-interest, realising that further progress depends on reasonable prices and efficient service. On the other side of the shield there is still a tendency among many local authorities to milk the profits of their electricity undertakings for the relief of rates, instead of relieving the consumers. In fact, there are faults in both kinds of undertaking, whether large or small, and it is impossible to relate efficiency with either ownership or size.

The Treatment of Cancer

IT has been recognised for some years that the effects of X-rays generated at more than 200-kV would provide a fruitful field for investigation. The chief requirements of radiation are the delivery of an adequate dose to a tumour deep in the body with brief exposure, which is related to voltage, and differentiation between normal and malignant tissue, which depends in part upon wavelength. The new installation at St. Bartholomew's Hospital has a range of from 250 kV to 1,000 kV, and its flexibility of control should permit the optimum conditions of treatment to be secured for different cases. It is the only one in the world for its purpose that operates at a sustained voltage of one million, and there are only four others of which we have knowledge designed for over half that figure. While the immediate object at Bart's is the relief and cure of cancer, a most important secondary consideration is the opportunity which the apparatus will provide for prolonged research into the therapeutic value of high-voltage radiation.

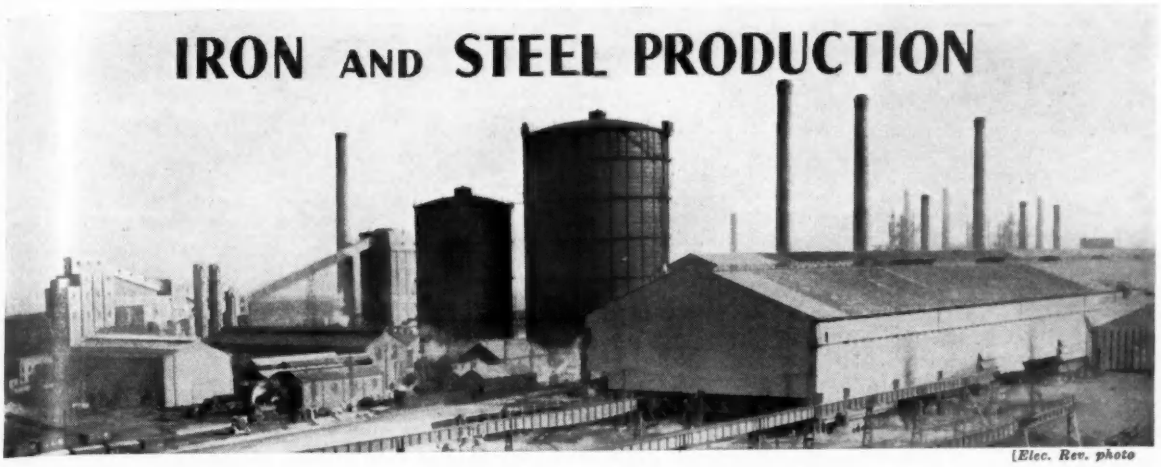
Old Wiring

THE question as to whether the I.E.E. Regulations should be applied to installations of thirty years ago provided an excellent topic for an informal meeting of the Institution. Such museum pieces as open fuses, knife switches and other accessories that introduce risks of injury or fire when used at 230 V a.c. should, of course, be replaced immediately, but a decision with regard to the wiring itself is more difficult, since this may have been installed in accordance with the I.E.E. Regulations then in force, which, Mr. R. A. Grierson showed, were similar in many essential respects to those of to-day. If the wireman-carpenter were better than his successors, as Mr. Grierson holds, any superiority in craftsmanship is more than balanced by the tendency of rubber to harden with time. The cost and disturbance to householders that would be incurred in the adoption of root-and-branch methods give reason for hesitancy, but few could find fault with the compromise put forward by Mr. W. R. Rawlings that, when it becomes necessary to interfere with old wiring —however serviceable it may seem—it should be renewed entirely, as sanitary and water services have to be.

New Cable Standards

THE evolution in rubber-compound production and vulcanising processes, and also in the tinning of individual wires, has now reached a stage at which the layer of pure rubber hitherto separating the conductors of a v.i.r. cable from two layers of vulcanised rubber can be dispensed with. In the New Year two types of C.M.A. grade and "Nonazo" class cables are to replace the four existing types. They will have a standard dielectric of three layers of v.r. compound and will be of approximately the same diameter for a given size. Classification will be, more reasonably, based upon operating voltage instead of on megohms—an improvement, since initial resistance tests are of notoriously little value in determining the continued reliability of the insulation of v.i.r. cables. B.S.I. standards are quantitative, but cable insulation depends more than almost any other electrical material upon the reputation of the manufacturer in its qualitative aspects.

IRON AND STEEL PRODUCTION



[Elec. Rev. photo

AFTER a recent visit to the large new works at Cardiff of Guest Keen Baldwin's Iron & Steel Co., Ltd., we feel that it is no longer sufficient merely to refer to electricity's aid to the iron and steel industry, but rather to that industry's dependence on our own. Modern iron and steel production involves the manufacture also of coke and gas, mainly as production media, and also of such by-products as sulphate of ammonia, naphthalene and benzol, and a yearly output of roughly 460,000 tons of pig-iron and 350,000 tons of steel (including blooms, sheet bars, billets and light sections) involves a consumption of some 45 million kWh, for the works are equipped with well over 800 motors varying in size up to 20,000 h.p.

From railway sidings in the works coal is tipped into hoppers and conveyed to the top of a Simon-Carves washery, where it is washed, screened and crushed and delivered to the service bunkers of the coke ovens. An indication of the advance in technique is the electrical connection of all the washery plant for sequence control. Two 300-h.p. auto-synchronous motors drive the coal crushers and are housed in a separate chamber away from the wet and dirt. They are remotely controlled by push-buttons from the crusher house. There are also two 150-h.p. motors on pumping duty in the washery.

A charger which runs along the top of the ovens is gravity fed from the service bunkers and delivers the coal to the ovens through roof doors. Two motors (40 h.p. and 15 h.p.) on the charger propel this machine as a whole and stir the coal in the containers, respectively. The electrical connection is via tee-rail and collector equipment with the conductors arranged on the oven structure at one side. In the ovens the coal is left to coke for eighteen hours or so under the influence of external gas firing, and when extraction of the gas is completed a pusher equipment pushes the coke right through, to be expelled at the other side on to a coke car to be taken to the quenching station.

For travelling, coke pushing, coke oven levelling and door lifting duties, respectively, there are four three-phase motors on the pusher equipment, all electrically interlocked to prevent the car from being moved whilst the ram is in the oven, and also to prevent the ram being moved until the door is clear. The door is lifted and swung round, the operating motor being controlled from the main platform. There is centralised control for the other motors from the driver's cabin.

The Morgan mill; electrically operated steam-driven flying shears in front

[Elec. Rev. photo

Gas leaves the coke ovens with suspended tar fog, which is removed by electrical precipitation before the gas is passed on to the by-products plant and finally to the one million cu. ft. gasholder. Precipitation is effected by the attraction of the particles to the wire electrodes connected to the negative pole and suspended in the gas passage. The electrodes are charged at 20,000/30,000 V by two 15,000-V generators connected in series and coupled on a common shaft together with a 9-h.p. driving motor, the machines being insulated from each other, while the generator frames are also insulated from earth. This cleaning plant as a whole is of English Electric-Whessoe design, and apart from this the main electrical uses in connection with the gas-handling plant are air-compressor, tar and by-product extraction pump, water pump and transmission equipment drives.

After being quenched, the coke from the ovens is automatically weighed and conveyor fed to the blast-furnaces as it is required for smelting the ore. Ore-laden wagons from the docks are received either by a hoist at the ore storage bunkers or by a similar equipment at a crusher plant, and they are discharged directly over the bunkers or on to the distributors over a storage ground along one side of the bunkers. A 210-h.p., 500-V, 500-r.p.m. d.c. totally enclosed motor drives the wagon hoist for the bunkers via a simple haulage-type drum winder, the winder and its drive being situated above the hoist, and the motor being push-button controlled from the bunker level. The average weight of the ore wagons handled by this hoist is about 25 tons.

The ore storage is served by a Stothert and Pitt 11-ton transporter crane with grab hoist on which the hoisting and closing lines are driven by 200-h.p. mill-type d.c. motors. The transporter is fed electrically by tee-rails and collector gear. Jutting out from either side of the transporter structure are two belt distributor units, each with a 5-h.p. belt drive and a 10-h.p. rope drive for travelling. The transporter travels partly over the bunker structure and it delivers its charge to the bunkers via a transfer car with a trolley wire feed and a 3-phase motor drive.

Rail-borne along the front of the bunkers are scale cars which select, collect and weigh the raw materials from the bunker chutes and discharge them into the blast-furnace skip-hoist skips. The scale cars are trolley-line fed and each is equipped with a travelling motor, door motor and air-brake compressor motor. The skip travels up a sharp incline to the furnace top, the hoist being driven by a 150-h.p. d.c. motor, with divertor control for precision in landing, governed by limit switches which are mechanically operated from the main driving shaft and, in turn, contactors on the control panel. There is a separate bell hoist which controls the dumping of the skip charge on to a rotating table at the top of the furnace, and the actual

feed into the furnace is electrically controlled to a time sequence by a face-plate type sliding-contact selector interlocked with the skip hoist control. For remote indication of the furnace charge levels there are both manual (push-button) and automatic electrically driven depth-rod equipments.

Before being passed to a three million cu.-ft. gasholder the gases from the blast furnaces are cleaned by a Lodge-Cottrell precipitation plant similar in principle to the detarring equipment for the coke-oven gas. The plant is arranged in four sections of pretreaters and four sections of fine-treaters, and it is served by seven transformer-supplied 80/100-kV rotary rectifiers, of which one is a spare. Blast-furnace gas is used for firing the coke ovens, while mixed coke-oven and blast-furnace gas is used for firing the steel-melting furnaces, soaking pits and reheating furnaces.

When a blast-furnace is tapped the iron is poured either into channels which feed the pig casting beds or direct into ladle cars. Of 60- or 120-ton capacity each, these cars consist of a large cylindrical container carried horizontally on trunnions, on which it is turned or tilted for pouring by a motor for which there are plug-and-socket feeds at the pouring stations. The ladle cars are hauled by locomotives to the steel melting shop for delivering the iron to the ladle cranes and, in turn, to the steel furnaces, or to the continuous pig-casting machine.

Scrap metal is also used in the steel furnaces and large quantities are received at the heavy and light scrap bays, the former bay being served by two Wellman 10-ton magnet cranes and the latter bay by a couple of Babcock 5-ton magnet and grab cranes. Part of the delivery system from the scrap bays to the steel furnaces consists of a hydraulic bundling plant with two 50-h.p. motors driving the pumps.

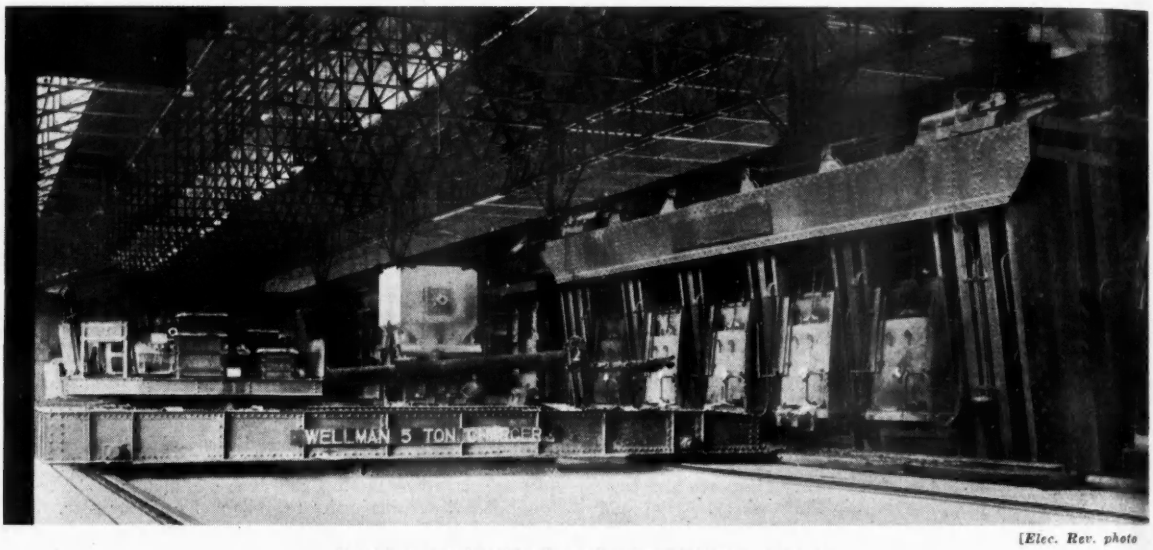
Of outstanding interest in the steel-melting shop is the electrical driving for the 200-ton tilting furnaces and for the 600-ton tilting mixer. Electric driving for such tilting work is believed to be a new departure in the iron and steel industry. Each tilting furnace is carried on a double roller track and the mill-type d.c. tilting motor drives through gearing and pinions a pair of racks directly coupled to the furnace body. The motors (120-h.p. melting furnace, 180-h.p. mixer) are remote controlled from either of two controllers—one at each side of the furnace.

On the charging side of the melting shop there are three Wellman low ground chargers with under-floor collector gear, each with five separately controlled motions, the travelling being cared for by two series motors in parallel, and a 60-ton Broadbent, and a 60-ton Babcock ladle crane, all with 480/500-V d.c. mill-type motors, while in the casting bay there are two 150-ton Wellman and one 120-ton Craven ladle cranes, also fitted with mill-type motors.

As previously mentioned, the furnaces are gas-fired, and a regenerative heating system is incorporated for the air supply for combustion. While air and gas are being passed through regenerators and so preheated, and into the furnace at one end, the waste gases are expelled through other regenerators at the other end, which is thus heated in readiness for the reversal of flow. Electrically driven valves control the directional flow of air and gas through the furnaces and similar geared motor (mill-type d.c.) drives are employed for the flue dampers, all the motors being remotely controlled by push button and limit-switch operated contactor gear. A similar regenerative scheme, but with time-switch automatic control is employed for the air and gas supply and reversal on the coke ovens and the Priest billet reheating furnace.

Before the waste gases from the steel furnaces are discharged to the stacks they are passed through waste-heat boilers which are coupled up to the main gas-fired boiler plant. Motor-driven fans of 100 h.p. and 200 h.p. are used for this duty and they are supplied independently of the works supply by a 500-kW Belliss & Morcom generator, the exhaust steam from which is used for feed-water heating for the waste-heat boilers. The fan motors can, however, be changed over to the normal works supply system at will.

For removing the vertically placed moulds from the ingots there are, serving the stripper bay, two 4-ton Broadbent cranes. Speedy and easy transport of the ingots from the soaking pits (gas-fired furnaces) to the blooming mill is effected by a remotely controlled ingot bogie with under-floor collector gear, the 75-h.p. driving motor of which is actually on the bogie, while the control gear is on a platform with a commanding view of the equipment.



[*Elec. Rev. photo*

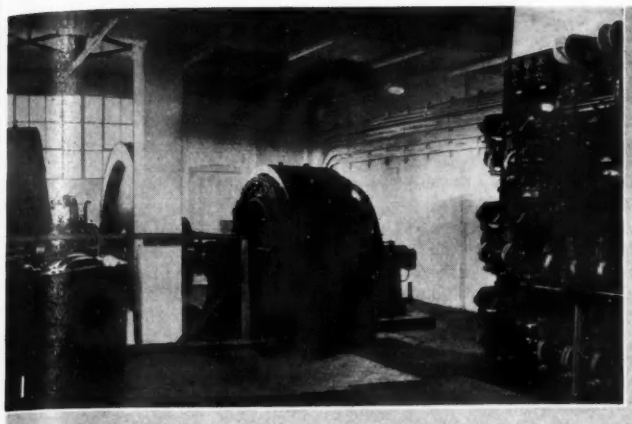
Steel-furnace charging floor showing Wellman chargers

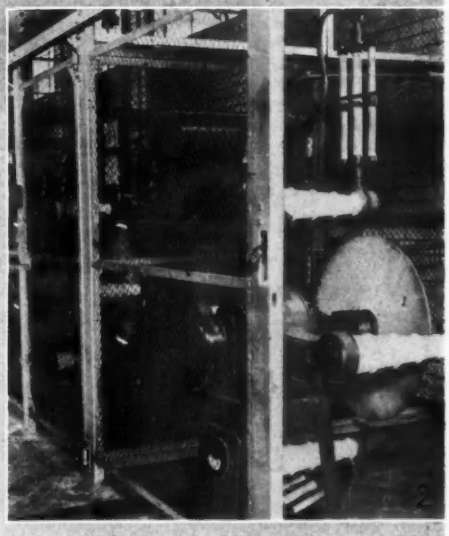
The blooming mill reduces the ingots to 5 in. by 5 in. blooms in seventeen passes in 1¾ minutes, and the 20,000 (max.) h.p., 1,470-V motor employed for this is believed to be one of the largest single-armature units engaged on such work, the armature alone weighing 75 tons. It is capable of reversing from 56 r.p.m. in one direction to a similar speed the other way in less than two seconds, and to flatten out the very heavy peaks resulting from such drastic treatment it is supplied by and directly connected to the generators of a heavy flywheel motor-generator set. The flywheel energy, of course, augments the mains energy at the peaks.

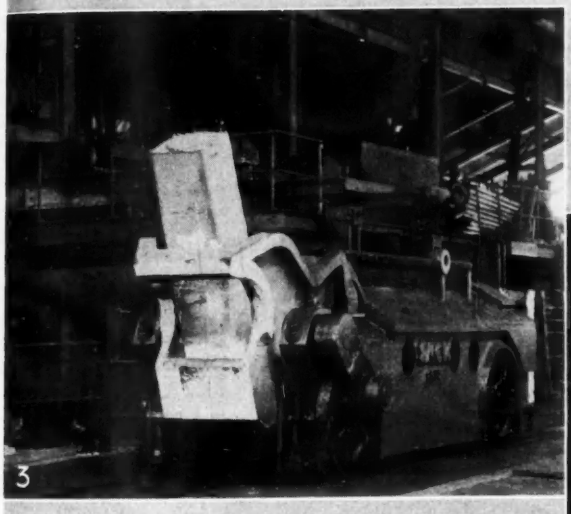
The 40-ton flywheel is carried on the same shaft as the three variable-voltage d.c. generators and the 5,000-h.p., 600-r.p.m. induction driving motor. The three generators are connected in series with the blooming mill motor, an arrangement which not only facilitates the Ward-Leonard control of the flywheel set, but also enables this to be run at reduced output in the event of a failure of one of the generators. The 600-kVA synchronous-asynchronous motor driving the exciter for the flywheel set is intended to maintain the power factor of the blooming-mill drive as a whole at 95 per cent.

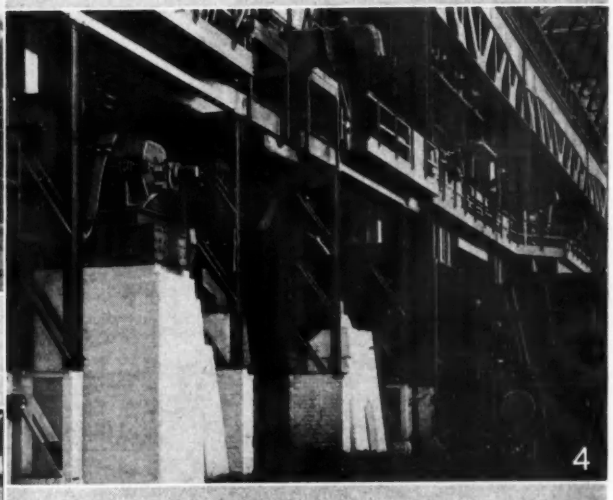
Apart from the main drive, major operations on the blooming mill are manipulating, or providing the necessary lateral and turning movements of the ingots, and screwing-down, or closing and opening the rolls. Surmounting the mill are the two 150-h.p. d.c. motors for the last-mentioned operation; they are connected in parallel and supplied from one of two motor-generator sets. A novelty for this particular operation is Ward-Leonard control, which is responsible for a considerable increase in the operating speed of the mill.

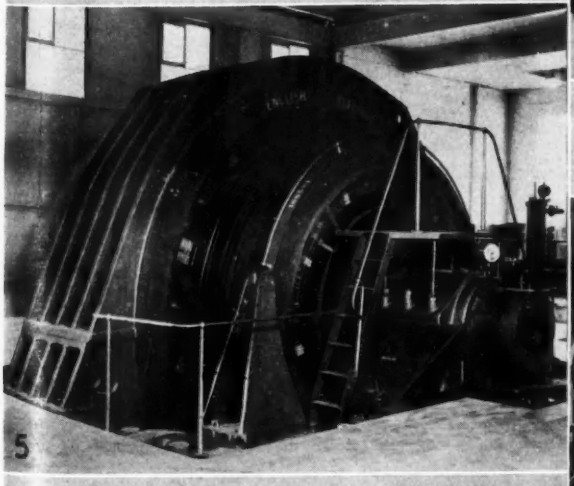
Cutting 12 in. by 12 in. blooms at the rate of five cuts per minute, which involves the starting from rest, accelerating to speed and stopping of large masses of metal, is the extraordinary performance of the bloom shears which are driven by a 350-h.p. high-acceleration, 960-r.p.m. d.c. motor. With simple "switch-on" starting, the speed variation is automatically controlled (acceleration by resistance and field regulation, and deceleration by regenerative, then dynamic, and finally by solenoid braking) by contactor gear. Slabs and

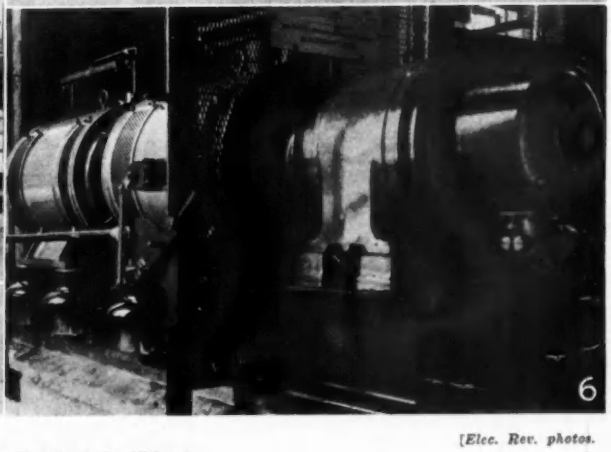












[*Elec. Rev. photos.*

In Guest Keen Baldwin's Works

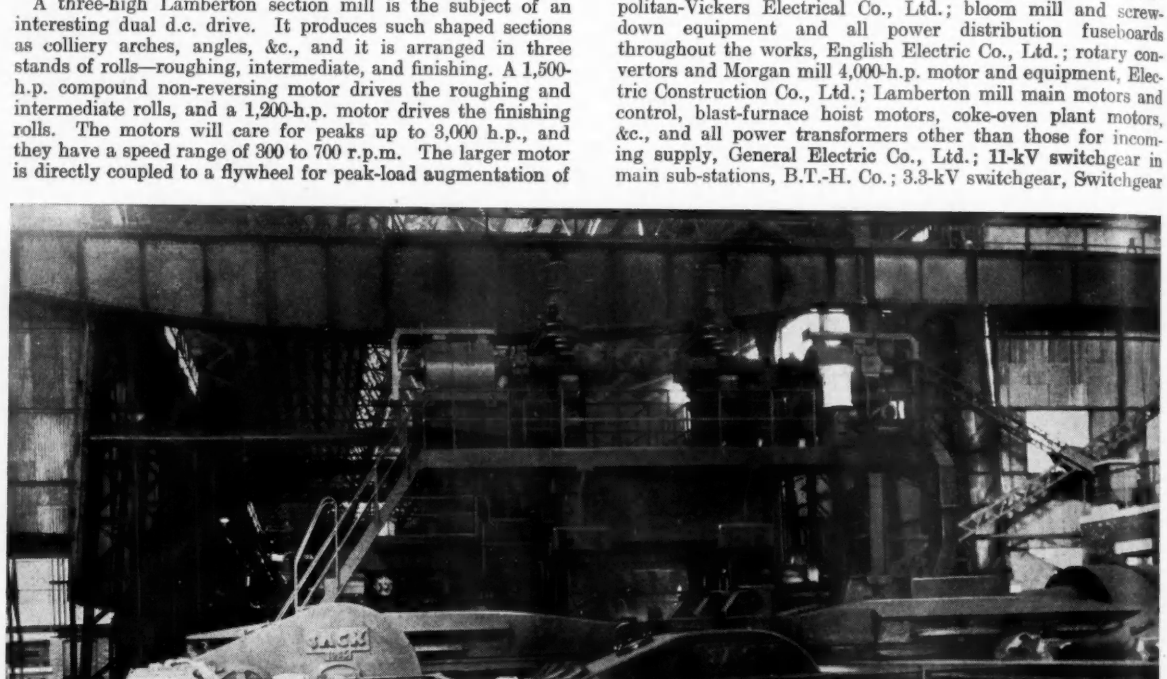
1. Flywheel driving set for Lamberton mill, showing some of the contactor control gear. 2. H.v. rectifiers of Lodge-Cottrell gas-cleaning plant. 3. A red-hot ingot on a bogie at soaking pits. 4. Casting bay of steel-melting shop showing tilting furnace drive. 5. 20,000 h.p. reversing motor driving blooming mill. 6. H.v. generators in the coke-oven gas de-tarring plant

blooms are further reduced to sheet bars or billets in a Morgan continuous mill driven by a 4,000-h.p. low-speed (100 r.p.m.) synchronous motor with auto-transformer starting, the windings of which are forced ventilated by means of Visco equipment. Emergency stopping is provided for by a "plugging" push-button on the mill floor. This motor is believed to be the largest of its kind employed for such work in this country. The six roll stands of the mill proper have bevel wheel gear drives from a shaft driven by the motor, while two edging rolls are individually driven by 125-h.p. motors.

A three-high Lamberton section mill is the subject of an interesting dual d.c. drive. It produces such shaped sections as colliery arches, angles, &c., and it is arranged in three stands of rolls—roughing, intermediate, and finishing. A 1,500-h.p. compound non-reversing motor drives the roughing and intermediate rolls, and a 1,200-h.p. motor drives the finishing rolls. The motors will care for peaks up to 3,000 h.p., and they have a speed range of 300 to 700 r.p.m. The larger motor is directly coupled to a flywheel for peak-load augmentation of the mains energy, and the contactor control equipment includes divertors. We saw bars from this mill being hot cut into required lengths by 150-h.p. and 75-h.p. motor-driven circular saws, and we were particularly interested in a new type of motor for a series of individual live-roller drives.

Another item of special electrical interest is the means of extracting light section bars from a furnace in which they are heated in preparation for bending. The bars are too light to be pushed through the furnace bar-to-bar as is the case in the other preheating furnace in the works. Gearing on this B.T.-H.-Gibbons development serves two rope drums, between which there is a little "free" movement. When driving the extraction jaws into the furnace the two drums rotate together by virtue of a rope which passes round one drum, down a well and round a sheave supporting a dead weight, and then back round the other drum. When the jaws meet a bar in the furnace they stop, but the motor continues to run, winding up the dead weight because of the "free" movement between the drums, and thereby operating a reversing switch which results in the withdrawal of the bar, at the end of which sequence a further limit switch stops the motor.

Manufacturers of the more important electrical equipment are as follows:—Incoming supply transformers, all mill-type motors and 350-h.p. bloom shears motor and equipment, Metropolitan-Vickers Electrical Co., Ltd.; bloom mill and screw-down equipment and all power distribution fuseboards throughout the works, English Electric Co., Ltd.; rotary convertors and Morgan mill 4,000-h.p. motor and equipment, Electric Construction Co., Ltd.; Lamberton mill main motors and control, blast-furnace hoist motors, coke-oven plant motors, &c., and all power transformers other than those for incoming supply, General Electric Co., Ltd.; 11-kV switchgear in main sub-stations, B.T.-H. Co.; 3.3-kV switchgear, Switchgear & Cowans, Ltd.; 400-V switchgear, 3,300-V motors, and 210-h.p. pump motors, Crompton Parkinson, Ltd.; a.c. and d.c. motors, Laurence, Scott & Electromotors, Ltd.; d.c. switchboard, Bertram Thomas; d.c. control gear on mills, cranes, transporter, steelworks, blast-furnaces, &c., Igranic Electric Co., Ltd.; a.c. control gear on washery, pumps, and d.c. control gear on ladle and scrap cranes, &c., Allen West & Co. Messrs. McLellan & Partners were the electrical consulting engineers.



[*Elec. Rev.* photo

The blooming mill which reduces ingots to 5-in. square billets in seventeen passes in 1¾ minutes

We are indebted to Messrs. Guest Keen Baldwins Iron & Steel Co., Ltd., for permission to view the works and to take photographs, and to Mr. J. W. Eastwood, A.M.I.E.E., the company's electrical engineer, and his assistant, Mr. A. L. Firth, for their assistance in the collection of the foregoing information.

South African Electrical Convention

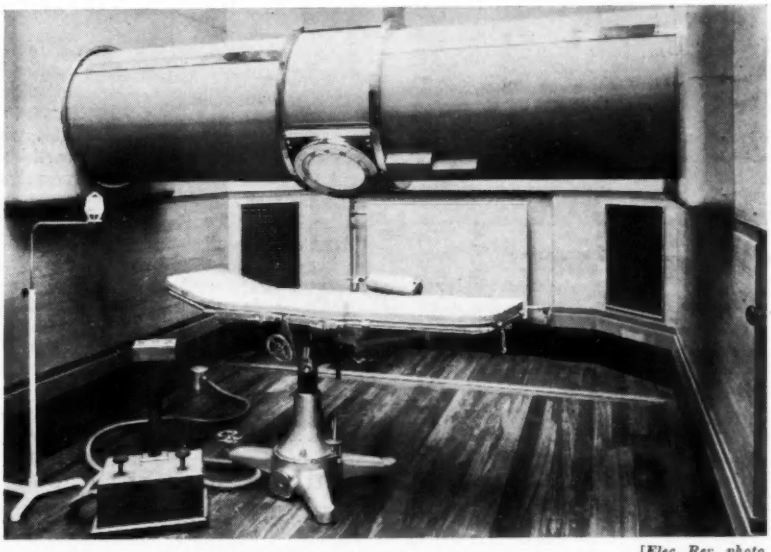
FIFTY-ONE municipalities were represented at a Convention of the Association of Municipal Electricity Undertakings of South Africa and Rhodesia in Johannesburg recently. The occasion marked the coming-of-age of the Association. Mr. A. Rodwell, M.I.E.E., M.I.M.E., of Johannesburg, was elected president for the ensuing year, the retiring president being Mr. G. G. Ewer, D.S.O., T.D., M.I.E.E., of Pietermaritzburg. Dr. H. J. Van der Byl, chairman of the Electricity Supply Commission, said that South Africa was undoubtedly in the forefront among the countries of the world in the use of electricity. In New York, in the streets away from the advertisement areas, the lighting was no better than that of South African towns and in many respects not so good. Mr. D. Leibbrandt stated that before the end of 1937 more than 20 per cent. of the rail traffic would be carried over electrified sections. The annual consumption of electricity for traction purposes would be approximately 257,000,000 kWh. The various types and equipment of the distribution sub-stations of the Johannesburg Electricity Department were described in a paper by Mr. R. W. Kane, who pointed out that a feature of the distribution system of recent years had been the rapid increase of bulk supply consumers. Mr. G. W. R. Le Mare, publicity officer of the Electricity Supply Commission, read a paper on national propaganda. It was unfortunate, he said, that the electrical industry in South Africa lacked a national campaign. The prime essentials for such a campaign were ability to supply electricity in the area to be covered by the campaign and to supply it at a rate sufficiently low to induce its general use. He said that, in the populous areas of the Union the charges were definitely attractive to the domestic user, but there were areas where they were above the level at which electricity was the cheapest as well as the best servant. He suggested that a central organisation should be formed to distribute propaganda articles to the Press. Other papers were submitted by Mr. W. H. Milton, B.Sc.(Eng.), an associate member of the South African I.E.E. ("Municipal Electrical Undertakings in Small Towns"), and Mr. Colin Dawson ("Municipal Peak Loads").

High-voltage X-ray Therapy

The new million-volt equipment at St. Bartholomew's Hospital

THE Mozelle Sassoon X-ray department of St. Bartholomew's Hospital, which was opened on December 10th by its donor, Mrs. Meyer Sassoon, is housed in a new building, measuring 75 by 40 ft., to the east of the Great Hall where so much valuable research in radiology was carried out by the late Dr. E. R. Canti.

The principal item in the equipment is a double-ended X-ray tube, 30 ft. long and weighing 10 tons, with a main vacuum cylinder of 14-in. steel tube which passes through the opposed walls of the treatment room and projects into the high-voltage positive and negative generation rooms on each side, where it is supported on 600-kV insulators on one of which is bolted the target flange and tube and on the other the cathode flange and tube. The target comprises a gold disc set in a copper head water-cooled by a radiator, fan and pump insulated for half the tube voltage to earth. Failure of the water supply automatically results in interruption of the high-voltage circuit.



[*Elec. Rev. photo*

The treatment room showing the 10-ton X-ray tube

Six filaments are mounted in a hexagonal head which can be turned through a rotating vacuum joint to bring any one into operation. Filament current is provided by a constant-speed generator mounted on the cathode support column and driven by a motor at earth potential through an insulated drive.

Current and hence electron emission can be varied from the control room by a rheostat in the filament circuit. In the lead from the negative high-voltage generator is a milliameter, the deflection of which is transmitted through a repeater mechanism to another milliammeter on the control desk.

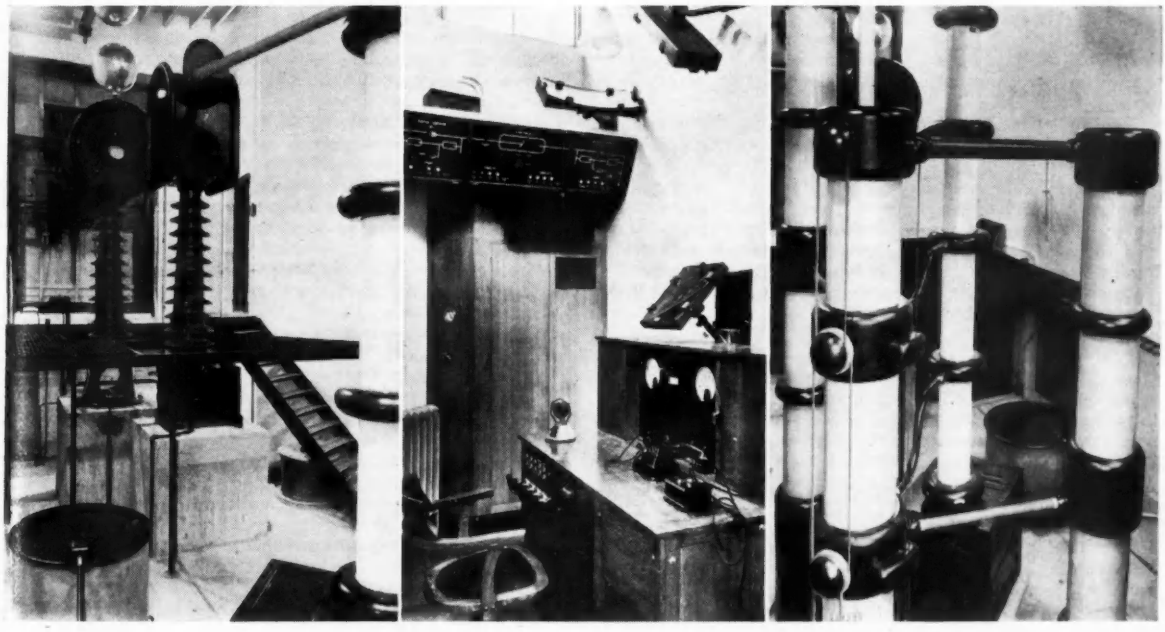
Joints between porcelains and the tube are made vacuum-tight by means of gasket and oil-sealing rings. Continuous evacuation of the tube is obtained by means of two high-speed oil-diffusion pumps backed by diffusion and rotary pumps, and with Apiezon oils a vacuum of 10^{-6} mm. Hg. is claimed. Relays and automatic taps make this apparatus completely self-controlled.

In order to confine the X-ray beam to the area required, the portion of the tube in the treatment room is surrounded by a rotatable steel cylinder filled with lead shot. When not in use the X-ray aperture points upwards and the beam is absorbed by a 5-in. lead block. On a cylinder rotated round the other by a motor, controlled from a pedestal in the treatment room, are mounted the applicators and lead diaphragm which limit the area of the beam and the distance of the patient from the tube target. In the applicator mounting are incorporated the chamber of an intensity meter, filters and their interlock switches. When the aperture is pointing into the lead block the X-ray intensity in the treatment room at full load is less than 10^{-5} Röntgen per sec.

With the applicator in position and the lead protected doors of the treatment room closed, the lead-filled cylinder can be operated from the control desk so that its aperture automatically aligns itself with that of the applicator. If the doors are opened the cylinder will immediately rotate to the safety position.

Energy taken from the 420-V single-phase network of the City of London Co. is stepped up to 150 kV and then rectified and multiplied by a stack of four continuously evacuated demountable thermionic valves and two stacks of oil-immersed condensers. Two d.c. generators (positive and negative) are each capable of generating continuously 10 mA at 600 kV with negligible ripple, the circuit employed being a two-stage Cockroft multiplier. The main transformer is supplied from an auto-transformer indirectly operated from the control room.

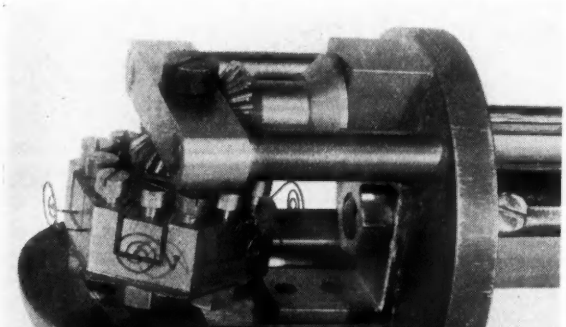
The two apparatus rooms (containing the positive and nega-



[*Elec. Rev. photo*

Left: Projection of the X-ray tube into the positive generator room. Centre: Control room showing illuminated diagrams and observation mirrors. Right: Condensers and rectifiers in apparatus room

tive d.c. generators) have been excavated to a depth of 8 ft. below the level of the rest of the department in order to give the necessary height of 22 ft. Radiation-proof walls, constructed of interlocking blocks of barium concrete, separate the treatment and generation rooms from the control and administrative section.



Cathode head with six-filament magazine

Mounted on a desk in the control room is a summation direct-reading voltmeter showing the output conditions of the generator representing the voltage between the cathode and the target. Beside the control desk is a mimic diagram indicating by illumination the sequences of pumping and high-voltage circuits, which are initiated by push-button switches. Communication between the control and the treatment rooms is by a two-way microphone and the patient can be kept under observation from the control room by a periscopic system of eight concave aluminised mirrors. There is also direct telephonic connection with the apparatus rooms.

Single-phase a.c. at 210-V is brought in from the City Co.'s mains for the loudspeakers, dosimeter and bell transformer. For lighting, power and occasional heating a 200-V d.c. supply is taken from the Charing Cross Co. Among the power applications is the air conditioning plant which provides ten changes of air an hour in the treatment room and five in the generator rooms.

Cables between the sub-station in the basement of the casualty ward and the control room are p.i., l.c., lead-covered and steel-tape armoured drawn into stoneware ducts. Within the building v.i.r. rustproof cables, taped and braided, are run in heavy-gauge welded-steel conduit with red lead and tow joints with special provision for earthing. Door switches prevent the energising of the main transformer when any of the ray-proof doors to the treatment or apparatus rooms are open.

The X-ray tube and generating equipment, with controls, relays and interlocks, were provided by the Metropolitan Vickers Electl. Co., Ltd., which also manufactured the barium-concrete blocks and aluminised the mirrors. Dr. Malcolm Donaldson is the director of the Cancer Research Committee and Mr. Ralph Phillips is in charge of the X-ray department.

Towards a Uniform Tariff. By D. J. Bolton

The case for a national maximum

TARIFFS have always formed a topic of insistent importance, and one that cannot be left out of any paper dealing with electricity supply or development. No matter what the starting point of the discussion, tariffs are bound to come into it sooner or later, and when they do come they usually arouse more interest (not to say heat) than any of the purely technical points. Nor is the reason far to seek. The long process of electricity supply, reaching from coal at the pit-head to electrical utilisation in the home or the factory, is a chain whose strength is that of its weakest link.

Each link that is dealt with and improved only intensifies the need of the remaining links—thus the more we improve our generation the more need is there to increase our sales, the greater our sales the greater is the strain on our distribution system, and so on. The weakest link at the moment, and the one most urgently calling for attention, appears to be that of tariffs and selling agreements. In fact (to vary the metaphor), if we do not rapidly improve our sales organisation this seems likely to form a "bottle neck" which will restrict the whole flow, however broad the channel may be in other parts of its course.

The simplest relationship known to mathematics is that of equality, and the simplest possible scheme of tariff unification would be to have one and the same tariff everywhere and for everyone. The possibility of a "universal" tariff of this kind has frequently been canvassed, and the matter was raised at the last session of the Institution of Electrical Engineers in a paper by J. A. Sumner. The suggestions then made could hardly be described as revolutionary, although a considerable advance on our present chaotic practice. They might be summarised in two statements:—(a) that rural distribution need cost no more than urban (of the same degree of development) and (b) that the time has therefore come when a standard form of tariffs and some nearer approach to equalisation of values is perfectly practicable. The discussion at the various centres throughout the country showed a surprising amount of support for this latter contention. Since then, the McGowan Report has been published, foreshadowing a reorganisation of distribution that would inevitably involve some degree of tariff planning.

The suggestions made below go a little further than this, although falling far short of a single universal price. Much has been heard, from the various political parties, of the "national minimum" and a great deal of post-war legislation has been in this direction. A minimum standard of living for all is now a recognised working principle, and in many directions is statutorily imposed. Why not a minimum of electrical facilities for all who want it—which means, in practice, a *maximum* price for electricity?

First let us be clear precisely what the suggestion is and what it is not. A national maximum in electricity tariffs does not mean one single tariff for all purposes, still less, one single flat-rate tariff. It does not preclude two or more tariffs (for different purposes) in the same area or the quoting of lower figures where these are justified by lower costs or necessitated by keener competition. What it does mean is that for any particular use of electricity there should be one *form* of tariff (or set of alternative forms) and one maximum price, and that these forms and prices should be the same for a factory in Maidstone as they would be in Manchester, the same for a householder in Hackney or in Hampstead.

Further than this it would be unwise to go at the present stage. In a product whose range is so wide and diverse, and for which a new use is found almost every week, flexibility is essential; and it would be a fatal mistake to level down instead of levelling up, or to harness future progress in the reins of present practice. The national maximum would be like the three-halfpenny post or the penny-a-mile transport—it would not preclude halfpenny circulars or cheap excursion trains. But whatever special arrangements might be made, the maximum price and the standard contract would always remain in the background as a guarantee to the consumer and a guide or check on the undertaking.

Possibility of Tariff Unity

There can be no doubt as to the propaganda value of such a scheme: the only question is as to its feasibility. Is unification of form a practical possibility, and would a maximum price be either so high as to give no protection or else so low as to ruin the more heavily capitalised distribution undertakings?

Such questions can only be answered in quantitative terms, *i.e.*, by specific suggestions and actual figures rather than by argument in words. In fact, the best way of proving the case is the method often followed in proving mathematical theorems: suppose it to be true and equate the quantities, then proceed to find values for the various constants. For if specific values can be found which satisfy both parties concerned in the tariff equation, and for all possible situations, the job is done.

Thus, to deal with the question of form, sufficient alternative forms of tariff must be drafted to meet all real needs and yet to make them few enough and simple enough to be a real improvement on the present muddle. When this is done maximum values must be assigned to each type of tariff which would be low enough to encourage development in each particular sphere without ruining anybody.

Before proceeding to this detailed consideration it will be well to look at the problem from the outside and see just what the difficulties are and why things have come to their present pass. Most things, it is true, vary somewhat in price, either with time or place, but it is safe to say that there is hardly anything which varies quite so much or so arbitrarily as the price of electricity. When we have exhausted all our eloquence explaining load factor and the rest we still cannot justify a

ratio of two or three to one in the price of identical services in areas only a few miles apart. No wonder the layman suspects profiteering and concludes that electricity differs from everything else not in what it is but in how it is run! If such widely varying commodities and services as gas and water supply, postage, rail transport and telephones are all capable of unification over wide areas, why not electricity?

Before evacuating a position which is clearly indefensible, it is fair to point out some of the special difficulties of the case, particularly those which have led to the use of the two-part tariff. Electricity is a hybrid—part commodity and part service—and like most hybrids it suffers from the disabilities of both its parents. In gas supply the major expenses are the proportional ones, whereas in water supply almost all the costs are overheads. That is why in domestic supplies a flat rate is usual for the one and a rateable value charge for the other—*i.e.*, the tariff corresponds to the major expense and neglects the other one. But in electricity supply, neither set of costs can be neglected, and a multiple tariff is almost unavoidable.

There is another respect in which electricity is a particularly difficult thing to price. All tariffs have two distinct sides to them—what may be called the supply and demand aspects, the one concerned with economic and the other with commercial considerations. The former imposes a lower limit and the latter an upper limit to the tariff, since in the long run electricity cannot be sold for less than it costs to make, nor for more than it is worth to use. Both limits are, of course, somewhat elastic and indeterminate; especially the upper one, since it is really a question of what the user *thinks* it is worth to him. Nevertheless, both limits do exist, however vague and difficult to determine, and are the ultimate "full stops" in the two directions of tariff fixing.

Most attempts that are made at rationalising existing tariffs and explaining their vagaries to the baffled consumer have been based on the economic argument, and have endeavoured to give them a costs justification. This is inevitable in any popular exposition, since there is something not quite respectable in the commercial argument; and, in theory at least, one should fix one's price by what things cost and independently of what one's competitors are charging. In practice such a plan would mean a complete hold-up of electricity development and an ultimate rise in price all round. Moreover, as an explanation of existing tariffs it leaves out quite half the picture.

From the point of view of tariff equalisation it is the commercial aspect that is the biggest difficulty. Thanks to the Central Electricity Board and the gradual equalisation of distribution densities costs do not vary so enormously, and the variation is likely to decrease rather than increase. There should soon be no very great disparity in the costs as between one town and another, or even between town and country. But there is, and is likely to remain, an enormous difference between electricity's competing power for different purposes and in different situations.

Practical Proposals

In presenting a case for reform one should endeavour to outline such tariffs as could conceivably be made universal, and to suggest how their adoption could be made virtually compulsory with little or no further legislation. Only the second of these aims is attempted in the present article. It will be clear at once that any plan which is to be satisfactory must be elastic—it must allow ample margin for hard cases on the one side and for bold experiments on the other. Whilst being successful in bringing most undertakings into line it must not ruin those few who are really unable to sell at the approved price nor must it hold back those eager spirits willing to sell more cheaply.

The proposals in brief are that the Electricity Commissioners shall prescribe (a) suitable types of tariff for each of the main types of load, (b) maximum values for each type. In some cases zoning might be permitted—*i.e.*, there might be higher maxima prescribed for backward and outlying areas. Undertakings would be able at any time to apply to the Commissioners to have their tariffs approved. Approval would be granted to undertakings either because their tariffs complied as they stood or because the Commissioners were satisfied that the departure from standard was justified under the special circumstances obtaining. This second type of approval would require renewal, say every three years.

So far, so good, but up to this point the proposals carry us very little farther than the pre-1926 position—*i.e.*, moral suasion rather than compulsion is relied upon. At this point, however, the Central Electricity Board would come in. The present grid prices are fixed for a certain period, after which it should be possible to revise them in a downward direction. It may even be feasible to have a single grid tariff, below and replacing the various existing tariffs.

Some time before the period expired the Board could announce its intentions regarding price reductions and could at the same time state that these would apply only to undertakings with "approved" tariffs. Undertakings whose tariffs had not received the seal of the Commissioners' sanction would continue to pay the higher figure. In this way the Commissioners' recommendations would carry the weight of financial inducement, and, where arguments have failed, economic sanctions might perhaps be successful.

But it is of no use making rules that cannot be kept, and no amount of economic pressure will suffice if the thing aimed at is not really possible. Unless a tariff or set of tariffs and values can be constructed which will find fairly general acceptance, any attempt to steam-roller the industry is likely to meet with much opposition. Can one, from the present welter, discover any guiding principles that can be used in such a construction? I believe that one can, and I have made some attempts to "rationalise" our present practice. The first step is clearly to collect and classify our specimens, since unless the old world of existing tariffs can to some extent be harmonised there is little hope of agreement on our ideal new world tariff.

At first sight the very magnitude of the problem and the greatness of the need makes a solution seem impossible. If within the confines of our small island and without any enormous differences of situation, needs or costs, some hundreds of different tariffs have spontaneously arisen what hope is there that a mere half-dozen types and values can suffice? It is possible to show, however, that, leaving out small undertakings, the great majority of tariffs can be classified into a comparatively few types, and, further, that these types themselves are not always so different from each other as they appear.

In surveying existing tariffs the procedure is first to group them according to the class of consumption, and then having fixed a lower limit of size, to tabulate all the tariffs in each class. It is usual to distinguish between five classes of consumption, namely, industrial power, private lighting and domestic, commercial lighting and heating, public lighting, and traction. Of these, the last two are necessarily the subject of special agreements since they concern only one or two consumers in each case. Tariffs for electro-chemical works, for restricted-hour services and for any other special purposes, would also lie outside the scope of the present suggestions. The other three main classes require separate treatment, when they will each be found to fit into a fairly simple scheme of unification.

As regard the magnitudes of the groups, separate figures are not wholly available, but the industrial and commercial together represent 56 per cent. of the energy sold, and 33 per cent. of the revenue received. The domestic group takes 34 per cent. of the energy and contributes 62 per cent. of the revenue. Hence these three groups cover more than 90 per cent. of the field, and if satisfactory tariffs can be devised for them the problem can be regarded as virtually solved.

Comment on the McGowan Proposals

WE have received from Mr. S. E. Britton, the city electrical engineer of Chester, a copy of a report which he has presented to his Electricity Committee bearing upon proposals for reorganising the distribution of electricity. This briefly reviews the history of electricity supply in this country and refers to the recommendations of the McGowan Committee and the report on these by the Association of Municipal Corporations. Mr. Britton agrees as to the necessity for reorganisation, but considers that areas should not be too large for easy administration or for the municipal officers to maintain personal contact with junior members of the staff. He thinks that a local authority undertaking's policy should be governed by the requirements and interests of the greatest number of consumers which it can serve while companies have to pay regard to the conflicting interests of their shareholders, directors and method of finance. Mr. Britton claims that because of this statistics show that local authority supply is more favourable to the consumer. It seems wrong to him to put out of business any well-organised local authority undertaking which happens to be surrounded by the area of a power company. The area of such an undertaking should, if practicable, be extended, and provided that local authorities combine their local government areas he sees no reason why sections of power companies' areas should not be taken from them. He suggests that distribution areas with a large rural proportion should have at least one fully developed and effectively organised urban supply area and have an extent of about 800 sq. miles, the supply being controlled by a joint board of local authority representatives. This would reduce the number of distributing bodies from 635 to about 200. Mr. Britton deprecates the "ten million unit" line drawn by the McGowan Committee and criticises the terms upon which it is suggested companies shall acquire municipal undertakings. He asks the City Council to pass a resolution embodying his suggestions. The matter was to be considered by the Council on Wednesday.

Future of Radio Relay Services. By Relay Engineer

FOLLOWING the Government's decision to defer for a period of three years the question of acquiring radio relay services it has been decided that such services must reach a reasonable standard of efficiency in technical and other respects. A new form of licence is being prepared for existing services permitting continued working for a period after the end of this year, and a technical questionnaire is being forwarded to all operators so that the Postmaster-General may be assured of the adequacy of the installations.

A memorandum of technical conditions has been drawn up applicable to new services established after December 31st, 1936, and to additional equipment installed at existing stations after that date. Detailed information of all apparatus it is proposed to use at new stations will have to be furnished by the licensee (or manufacturer) to the Post Office, showing how the requirements in the memorandum have been met.

Technical conditions of the new agreement

Performance Requirements

The receiving apparatus is to be suitable for the efficient radio reception of transmissions from broadcasting stations, and the characteristics of the complete system are to be such as to ensure reasonably faithful reproduction of the original music or speech. The design, manufacture and installation of all equipment, including internal, external and subscribers' apparatus, are to be to the approval of the Engineer-in-Chief of the Post Office, and every facility is to be given for inspection and tests at any stage of installation or subsequent operation and, where applicable, of manufacture. The construction and materials of the equipment are to be of the highest grade and the work is to be carried out with British labour. The components must conform to British Standard Specifications where applicable and, in addition, they are to be of British manufacture.

Panel, unit and rack, or framework construction is required for the apparatus, and it must be so arranged that adequate protection is provided against dangerous voltages. All operating controls and switches are to be mounted on the fronts of the panels or control desk, and all components are to be readily accessible for maintenance purposes. Adequate fusing arrangements are specified and provision for quickly measuring valve-anode currents is required.

The type of receiver is optional, due attention being given to the purpose for which it is to be used. For distant-station reception the sensitivity of the receiver is to be such that with a carrier input (into an artificial aerial) of 100 microvolts, modulated 30 per cent., the output is to be of good quality and of the correct level for application to the succeeding amplifier. For local-station reception only, the sensitivity of the receiver is to be adequate for producing the requisite output power with good quality, having regard to the known field strengths of the B.B.C. stations intended primarily to serve that particular area.

Compensating for Fading

Receivers intended for the reception of other than the local station must be provided with a.v.c. to compensate partially for fading, so that for a variation of 40 db in input signal strength the low-frequency output varies by no more than 10 db. It must start to operate with an input not greater than 100 microvolts, and must be so designed as to avoid modulation distortion. For local-station reception, except where the field strength of the local station exceeds 100 millivolts per metre, the selectivity is to be such that the h.f. and/or i.f. response to any frequency differing from the carrier frequency to which the receiver is tuned by 20 kc or more is decreased by 40 db, compared with that of the tune frequency. For distant-station reception the selectivity is to be such that, if required, frequencies differing by 9 kc or more can be attenuated by at least 45 db, compared with that of the tune frequency.

The overall characteristics of any local-station receiver and its associated low-power line amplifier are to be such that the response to the audio-frequency modulation of the received broadcast-station carrier has a value within ±4 db of the level at 1,000 cycles over the range of frequencies between 50 and 7,000 cycles. For distant-station reception this range of frequencies may be reduced to between 50 and 4,000 cycles, and be within ±6 db. The audio-frequency characteristics of the high-power amplifier, together with any associated low-power line amplifiers, are to be within ±2 db of the level at 1,000 cycles over the range of frequencies between 50 and 7,000 cycles.

Adjustable tone control may be incorporated in the l.f. stage. The proportion of harmonic content is not to exceed 5 per cent. of the voltage level at the input to the subscribers' distribution network. With the receiver and amplifiers adjusted for normal working the ratio between the set noise, with the input unmodulated, and the l.f. output of the receiver resulting from a 30 per cent. modulation, is to be at least 45 db. For the high-power amplifier, with the input terminated in a suitable non-inductive resistance, the ratio between the set noise and the normal output must be at least 50 db. These measurements will be taken with a r.m.s. volume indicator having a flat response from 50 to 7,000 cycles.

Minimum Power

Sufficient power must be available to ensure a minimum of 25 V r.m.s. at 1,000 cycles across each subscriber's loudspeaker, and the variation in power supplied to each subscriber due to load and/or weather conditions must not exceed 5 db. The simultaneous difference in power supplied to the subscriber receiving the greatest power and the subscriber receiving the smallest is not to exceed 5 db. Each speaker connected to the service should have an impedance of at least 5,000 ohms throughout the range 50 to 7,000 cycles, and must be fitted with a volume control. Existing systems using loudspeakers not conforming to this standard will be permitted to load to full capacity existing main feeders by using the type of loudspeaker formerly employed. Power-supply arrangements must be such that all technical conditions are complied with notwithstanding the variations permitted on public supply mains (±6 per cent. of the declared value).

Distribution of programmes at carrier frequencies is prohibited, as is the use of the "earth" as part of any circuit for programme transmission. Under certain conditions, however, permission may be given to operate signalling or remote-switching systems over the transmission lines between two amplifying stations using an earth return. Output transformers on power amplifiers must be provided with screened primaries, the screen being connected to earth. The insulation between any winding of the transformer and the screen and core must withstand for two minutes the application of 50-cycle a.c. at 1,000 V or twice the output valve's anode voltage, whichever is the greater. Other regulations have been drawn up to ensure that dangerous voltages cannot reach lines connected to the subscribers' network.

To prevent interference with telephone and telegraph communications and with reception on normal broadcast receivers, distributing wires must be erected, as far as possible, remote from or at right angles to existing Post Office wires or aerials. To avoid contact with Post Office wires a clearance of 2 ft. must be observed. Post Office lines may continue to be used on a rental basis between a receiving station and an amplifying station or between two amplifying stations, but in future circuits will only be provided on a direct station-to-station basis and repeating valves must be used at every junction, no omnibus (or teed) connections being permitted. The power to each Post Office line must not exceed 5 milliwatts, and cross talk from other Post Office circuits must not be audible to subscribers.

Rate of Expansion

Most of the larger operating companies are already using equipment conforming in the major part to the new regulations, but to some of the smaller concerns where less capital is available the standards may seem impossible to attain. Reassurance may be had from the statement that while the Postmaster-General reserves the right to consider upon its merits the adequacy of existing installations he will pay due regard to the circumstances in each case.

The uncertain future of the industry is seriously retarding progress. Schemes of expansion and improvement cannot be embarked upon until some assurance is given that adequate compensation will be made in the event of the Government's assuming control. The following statistics serve to illustrate the present position :—

	Total number of subscribers.	Total number of stations.	Percentage of relay listeners to total licences.
September, 1933	57,249	228	—
September, 1934	164,103	303	2.53
September, 1935	213,977	338	2.96
September, 1936	235,691	347	3.02

During the past year the normal process of extending service areas and connecting new subscribers has proved too great a speculation for many relay operators, with the result that business is declining.

Economisers and Air Pre-heaters.

By V. Walker

Conditions governing their design and operation

PRESENT-DAY standards of boiler efficiency require exit flue gases to be so reduced in temperature that an economiser or air pre-heater, or both, may be incorporated in the installation. The use of the economiser continues, regardless of the high temperature of the feed water resulting from interstage feed heating, as the tendency to increase boiler capacities results in higher exit gas temperatures which would often be excessive for air pre-heaters alone.

For high-pressure boilers the steel-tube economiser, with either gilled or plain tubes, is employed. Gills are generally of cast-iron shrunk on to the steel tube and made in sections about 8 in. long, being provided with a spigot and socket joint so as to prevent corrosive gases from coming in contact with the tube. An H gill has been adopted for several large British power stations; it has the advantage that the tubes are assembled so that the gases flow through rectangular straight passages, the smooth surface being kept clean by a soot blower which moves across the end of all the passages.

In earlier designs of economiser the tubes were expanded into headers. There is now a tendency to substitute for the headers either return bends connected by the "lens" type of joint with the gilled tube, or hairpin bends made possible by the development of flash welding with the plain type of tube.

One of the chief items of maintenance on high-pressure economisers is the leakage of hand-hole joints in the manifolds. These hand-holes are closed in some designs by a tapered plug and mild-steel ferrules which are drawn tight by a cap and nut and are easily replaceable if rendered defective through water cutting the metal. If the seat in the header is cut it must be trimmed with a special tool.

Solid-annealed copper and double-copper jacketed asbestos gaskets do not appear to give such satisfactory service as corrugated monel metal and mild steel gaskets for high-pressure operation. Leakage of the rolled joints at the headers and the hand-hole gaskets is to be attributed primarily to rapid changes in temperature of the water passing through the economiser during starting up periods, and has been overcome in some instances by fitting a by-pass which allows water to recirculate from the boiler drum through the economiser.

Internal corrosion of economiser tubes seldom occurs when the feed-water is deprived of its dissolved oxygen either in the main condensers or in a de-aerating plant. External corrosion caused by condensation of acid flue gases or leakage at the joints is, however, often the cause of tube failure, to overcome which alloy-steel tubes containing chromium copper and silicon are being tried. External corrosion may also take place in the region between the tube plate and the return bends, which are often filled with insulating cement, which retains moisture from tube leakage.

A recent design of economiser, which has been adopted in several large American installations, is one in which each unit consist of four finned tubes, one end of the tubes being connected by integrally forged return bends and the other, at the header, by bifurcations, which are connected to adjacent units by steel return bends. Only two joints are required for each four tubes and easy access is given for internal inspection and cleaning. The thickness of the tube end on the bifurcation is independent of the thickness of the tube within the economiser chamber. The tube end and the 180-degree tube bend are made of equal thickness. A soft steel gasket is placed between the tube and return bend and the joint is made by welded sleeves or is tightened by three-bolt flanges screwed to the end of the elements. Where local conditions permit, the heating surface is a continuous loop comprising bifurcated tube units of six or eight tubes in height.

The practical limit to the pre-heated air temperature is that which can be used with commercially available fuel firing equipment. With stoker-fired boilers, an air temperature of 350 deg. F. is seldom exceeded, as above this temperature maintenance costs increase and there is trouble in firing due to "cauliflowering."

Increased efficiency and freedom from soot and fine ash deposit have been obtained by a new design of heating surface in regenerative air heaters, in which the corrugated plates of earlier designs have been replaced by flat sheets having longitudinal spacing ribs proportioned to keep the crimped plates between them far enough apart to give the desired sectional area to the passages. The crimped plates instead of having their undulations crosswise to the companion plates, have undulations at 30 deg. to the path of travel, and the radial seating strips have been modified to meet the demand for increased pressure differences and to reduce air leakage. The heaters are now driven from the centre, instead of at the outer rim, the rotor being suspended by a large thrust bearing at the top of the casing, which aids sealing against air leakage.

Corrosion and fouling of the heating surface on the gas side at the air-inlet end are the most common troubles of air heaters. Clogging is caused by the temperature of the metal on the gas side being below that of dew point, thereby causing condensation and in many cases the slow deposition of concentrated acid even at temperatures as high as from 250 to 300 deg. F. This forms a bonding medium for dust carried by the flue gases, the effect being cumulative as the gas side becomes insulated with the result that the metal temperature is further decreased.

Decided temperature differences have been found between the metal of the tube wall and the gases passing through the tubes at the gas outlet, giving evidence of stratified flow within the tubes and dew-point temperature of the metal. The insertion of special metal strips in the tubes has been found to reduce this temperature difference to a few degrees and to remove the corrosive film from the tube walls.

Tube fouling is often due to the heating surface in contact with the incoming air being deprived of its full share of the outgoing gases, a condition which is often aggravated by the tendency of the gases to travel by the shortest path provided by the central banks, but which has been corrected by the use of deflector vanes. If the air heater is so designed that uniform gas and air distribution is assured, the temperature of the gas exit can be very much reduced without corrosion at the cold end. Heaters of the plate type are now so constructed that sections can be isolated and removed for cleaning, and elements can be reversed when corroded at one end. In the tubular type, a secondary section of short tubes is used to permit of easy cleaning and replacement at the cold end.

[*Elec. Rev.* photo

The new Cameo Cinema, Victoria Street, S.W., showing the impressive neon pinnacle of light (see page 865).

American experience indicates that pre-heaters are less subject to corrosion on pulverised-fuel than on stoker-fired boilers using the same class of coal. In order to ascertain the reason for this, fly ash was collected from the flues, the collecting receptacle being maintained at various temperatures, and the sample afterwards mixed with distilled water. After standing for a few hours the water was filtered from the sample and its pH value obtained. When the fly ash was collected at the temperatures of the gases leaving the air heater, the water was found to be strongly alkaline, but as the temperature of the collecting container was reduced the alkalinity became less pronounced. At a temperature of 100 deg. F below the dew-point of the gases it was still slightly alkaline.

From these tests it would appear that pulverised fly ash has a strong affinity for absorbing acid moisture, that when the ash leaves the flue gases at temperatures above their dew point, it is strongly alkaline and that the temperature can be reduced considerably before the resultant reaction becomes acid. The ability of fly ash to absorb acid moisture therefore enables it to carry off the moisture mechanically, preventing its being deposited on the metal parts.

Meetings and Discussions

Switching and switchgear figured prominently in the discussions of electrical associations during the past week. A form of micro-gap switch for non-inductive a.c. circuits which is "perfect" in action was referred to at the I.E.E. in London, which also considered a major problem in the determination of the effect of the form and amplitude of restriking voltages on circuit-breaker operation. At Cardiff the need for an independent switchgear testing station was suggested. That a well-devised two-part tariff stimulates development has been proved in practice, but there does not seem to be general agreement on the best method of calculating the fixed component. Support for the size-of-house basis was forthcoming in a paper submitted to the A.S.E.E. The interdependence of metallurgical development and engineering progress was dealt with in another paper.

Switching Problems

TWO papers were presented at the December 17th meeting of the INSTITUTION OF ELECTRICAL ENGINEERS in London. One by Prof. W. M. Thornton (of Armstrong College, Newcastle-on-Tyne) points out that a form of micro-gap switch for non-inductive a.c. circuits is now available which is "perfect" in action insofar that when the circuit is opened at any point in the half cycle it prevents the restoration of the arc after the current has fallen to zero.

The Satchwell (thermostat) arrangement marked a new departure in the automatic control of low- or medium-voltage a.c. circuits, particularly when they are as nearly as possible non-inductive. This type of switch is operated by a bimetallic device. The length of gap is adjusted by a back stop so spaced that the current, after passing through zero, cannot restrike. Oscillographic records show that at whatever point in the cycle the contacts open the current stops at the next point. This is sufficient evidence of the "perfect" action of the micro-gap switch.

The restriking of the arc depends on the voltage across the gap and the conducting state of the medium in it. Dr. Thornton's paper shows that the best point at which to break the circuit is not when the current is zero, but in the quarter period before a zero point. There must be some electrons in the gap to repel one another and to break the circuit.

If there were no voltage gradient in the gap any electrons in it would repel one another and be expelled sideways as if there were a miniature explosion. This can in fact be seen to occur. It is the special and characteristic feature of micro-gap breaks that the current is always broken only by a lateral spread of the arc through mutual repulsion of its elements, not by stretching the arc.

The electric strength of air between parallel surfaces is such that an alternating voltage of 250 r.m.s. or 350 V maximum will not break down a gap of 0.005 in. For a 500-V circuit, 0.01 in. is required. These define the gap lengths that may be used. Even with the latter relatively large gap a circuit carrying 100 kW has been interrupted without the arc restriking or the contacts pitting. How far it may be possible to apply the lateral-repulsion action to higher-voltage circuits remains to be seen.

Oscillograms in most cases showed that the gap began to open at the moment the current reached a maximum value, always of the same polarity. This suggested that there might be in addition to the thermal expansion an electromagnetic action causing the gap to open. The switch when delicately set would operate with large currents without any expansion of the thermostat elements. This effect had been observed before, though not explained. It is clearly due to a resultant weakening of the magnetic hold of the permanent magnet on the soft iron armature. The magnetic field of the current flowing through the contacts over the permanent magnet to the terminals deflects the field away from the poles and weakens the resultant pull. A switch of this type therefore breaks automatically on overload and is an additional safety device in the circuit.

The second paper, by Messrs. H. Trencham and K. J. R. Wilkinson (B.T.H. Co., Ltd.) states that the determination of the effect of the form and amplitude of restriking voltages on circuit-breaker operation is a major problem. Its solution is virtually impracticable unless one has means of ascertaining easily and accurately the voltage-time curve of restriking voltage inherent in any desired part of the system under examination.

The authors describe in some detail a cathode-ray instrument designed (by the organisation with which they are connected and now in use by the Switchgear Testing Co., Ltd.) for indicating the shape of the transient restriking-voltage wave which is incidental to, or inherent in, any circuit conditions, thus enabling the indications to be observed, traced or photographed.

The performance of any breaker is the outcome of the two contending factors, restriking voltage and the characteristic of insulation build-up, so that any statement regarding severity of restriking voltage implies a knowledge of the second factor. Thus a rational comparison of severity between any two restriking-voltage waves is impossible without reference to some characteristic, either known or implied, of breaker vulnerability. Until this knowledge is available, therefore, it is not logical to attempt to define restriking-voltage severity.

Lacking any direct means of measuring the rate of insulation build-up within a breaker, it is now rendered possible by means of the restriking-voltage indicator to plan a programme of tests in which, by separate control in suitable steps, of voltage, and shape of a restriking-voltage wave, the vulnerability curve of a breaker can be plotted from its performance.

Switchgear Failures

AT a joint meeting of the South-Western Section (W. Division) of the ELECTRICAL POWER ENGINEERS' ASSOCIATION and the INSTITUTION OF ELECTRICAL ENGINEERS (Western Centre), held in Cardiff on December 8th, Mr. H. W. Swann, Chief Electrical Inspector of Factories, opened a discussion on his 1935 "Report on Electrical Accidents." Mr. E. Jones, city electrical engineer, Cardiff, presided.

Mr. Swann called for the views of those present on the subjects of fire protection, the need for an independent switchgear testing station (apart from the three main stations controlled by switchgear manufacturers), especially one in which small station plants could undergo tests, and the desirability of bus-zone protection. He also asked whether secondary explosions were not the cause of considerable damage in switchgear accidents, and whether the use of oilless switchgear similar to that which was being manufactured on the Continent was being fully considered.

Mr. J. M. Goodall said that the report seemed to suggest that switchgear that failed at low kVA would be increasingly liable to failure as the kVA was raised. This was not so, as with high kVA a rapid generation of pressure was caused, whereas with low kVA a slow generation of pressure often allowed of slow burning of the gases. He recommended mechanical or spring closing of switchgear, with a pre-determined closing pressure, in preference to hand closing at over 150,000 kVA, in order to safeguard the operator.

Mr. Taylor suggested that the butt closure was more satisfactory than the use of socket fittings, as it would always make contact however badly pitted or corroded, whereas with the latter one phase might become welded so that the other two phases could not be closed. Mr. Blount said that explosions were rarely experienced in switch stations where the vents were taken outside the building. The reason why a wall might shift although only a few panes of glass in the building were broken was possibly that a pressure wave was reflected across the building after the explosion, striking the wall after missing the windows.

Mr. Coats expressed the opinion that with manifold vents gas pockets were possible, and the gas thus trapped gave rise to further secondary explosions. The view put forward by Mr. Wood, that a weighted flap fixed to the building would allow relief of pressure but would prevent the escape of CO_2, met with general agreement. It was also suggested that a roof of light construction would meet the case. This would lift in an explosion and relieve the pressure while the CO_2, a heavy gas, would still do its work. Against this was put up the recommendations of the Air Ministry which call for a strong roof to withstand possible enemy air raids.

Mr. C. J. O. Garrard warned the meeting of the dangers of making circuit-breakers too complicated. Simplicity was the hall mark of good gear and complicated interlocking arrangements too often defeated their own ends. The amount of oil and compound required could be reduced by suitable design, *e.g.*, by the use of condenser bushings on bus-bars. Regarding bus-bar protection, he put forward the mesh connection now used in some grid sub-stations, which disconnected only the faulty section. Short-circuit currents of 45,000 A (110,000 A peak-making currents) were the maximum permissible, which limited the breaking capacity to about 33,000 kVA at 400 V and 500,000 at 6.6 kV.

Mr. Kernick (South Wales Electric Power Co.) made a plea for better accessibility in switchgear, and pointed out that

gear of different design and capacity was required where overhead transmission was used, especially in mixed systems. Mr. Goodall stated that oilless circuit-breakers had been developed abroad because foreign switchgear was more prone to accidents than British gear. Compressed air was one of the methods used to quench the arc, and experiments with a mixture of glycerine and water were being carried out. Many accidents in this country were due to the overloading of switchgear, particularly in industrial plants. Faults did not occur in circuit-breakers of adequate design working well within their rated capacity.

A film shown by Mr. Blount demonstrated how a unit was proved at the test station of the Switchgear Testing Co.

Metallurgy and Engineering

METALLURGICAL developments and engineering progress was the subject of Sir William Larke's presidential address to the JUNIOR INSTITUTION OF ENGINEERS in London on December 11th, his object being to illustrate how much the material progress of mankind owes to collaboration between metallurgists and engineers, the latter being limited to some extent by the materials available.

In this country more emphasis has been rightly laid on high temperatures than high pressures. The possibility is envisaged of pressures in power stations in this country ranging in the future from 1,300 up to 1,900 lb. per sq. in. with total temperatures up to 1,000 deg. F.

A steam turbine has been built in this country for service in Detroit, U.S.A., of 10,000 kW capacity, 3,600 r.p.m. operating at approximately 365 lb. to the sq. in., and at a total temperature of 1,000 deg. F. This has involved engineering and metallurgical problems hitherto unsolved. It has been in operation for 25,749 hours, and out of this period the steam temperature at the stop valve was 1,000 deg. F. for 21,938 hours. The turbine consists of two cylinders, the high pressure one being made of nickel-chrome-molybdenum alloy steel, which has proved entirely satisfactory, no trouble being experienced from "creep" either in casing, rotor or blading.

The immediate effect of increasing the thermal efficiency of power stations will be to reduce the cost of electric power to industries. If the cost of the thermal production of electric power in this country is substantially reduced, it may well exert a powerful influence on the metallurgical industries by cheapening their cost of production by electric furnace methods. This will still further extend the development and uses of high alloy steels, which are at present precluded by their relatively higher cost. Thus the metallurgist, by his advance in the production of new materials, enables the engineer to obtain increased thermal efficiency which, in its turn, may in due time provide the metallurgist with electric power at such a low rate as may substantially reduce the cost of high duty alloys. The rapid growth of the use of copper coincides with the development of the electric age. The hollow conductor is now being considered for a transmission line in the U.S.S.R. at 400,000 V.

According to Matthewson, in the United States in 1933 approximately 370,000 tons of copper was used, of which 22 per cent. was used in electrical machinery and plant, and 7.5 per cent. in electrical transmission lines, cables and distribution generally. The consumption in the United Kingdom in 1934 was 220,000 tons, a higher ratio in proportion to population, of which one-half is used for electrical purposes.

In electrical engineering the necessity for obtaining high mechanical strength for trolley, telephone, telegraph and power transmission lines, coupled with high electrical conductivity, has presented a difficult problem, since most of the elements alloyed with copper have a detrimental effect on conductivity. It is, therefore, generally necessary to sacrifice some degree of conductivity to secure the mechanical strength desired. A remarkable alloy of copper, with 2 to 3 per cent. of beryllium, has been produced, which by a simple heat treatment can be given a tensile strength of 60 to 90 tons to the sq. in., approximating to the properties of alloy steels with a very high resistance to fatigue.

Aluminium has also largely entered into the electrical field. For example, the electricity grid in the United Kingdom consists of 4,000 miles of overhead transmission lines containing some 12,000 tons of aluminium, and, incidentally, 150,000 tons of steel in the supporting towers. It is also largely used in electrical instruments, switch cases and containers of various kinds. In fact, without aluminium and its alloys engineering development of the last twenty years would not have been nearly so far advanced.

What is the Best Domestic Tariff?

THE two main assertions in the paper "Development of Domestic Load in Relation to Tariffs," by Mr. F. W. Purse, chief engineer, London and Home Counties J.E.A., presented to the ASSOCIATION OF SUPERVISING ELECTRICAL ENGINEERS this week, are that a two-part tariff is vital to healthy domestic development and that the most suitable one in existence is that based on the outside measurements of the premises. Indeed, he would have such a tariff adopted as a compulsory standard for domestic supplies. He says that with a two-part tariff domestic development proceeds in snowball fashion, and that once the consumer grasps the potential advantages at his command he then extends his use of electricity.

The two-part tariff ensures a minimum return from each consumer and is regarded as a form of rent. Further, it affords great flexibility as both the fixed and the running charges can be varied by small amounts. Again, the author points out that all undertakings have a fixed-charge component of costs related to the number of consumers connected and to their demands, and that most supply undertakings are charged for their bulk supplies on a two-part tariff. Mr. Purse thinks that increased consumption per consumer, coupled with diversity factor, enables a two-part tariff to be offered on reasonable terms, and that the average consumption will increase by five times and upwards after the adoption of such a tariff. To those nervous about peak-demand problems the author says he thinks that with further extended use of electricity, coupled with a still wider adoption of the two-part tariff, the peak demand per consumer will probably rise, but that there will be sufficient consumption increase to compensate for the higher peak.

In his search for the most suitable two-part tariff the author condemns all efforts to find the "perfect" method of charging. If practicable, the perfect tariff would probably embrace a fixed charge relating to the actual kW demand of the consumer at the time of the maximum demand on the undertaking, but the cost of recording the maximum demands simultaneously would be prohibitive and there would be a public outcry against the resultant diversity of charges.

It is also contended that, like any other commodity, electricity must be charged for on a basis of averages, and among the illustrations of the methods adopted for charging other commodities are: Water, lump sum on rateable value; railway travelling, charging what the traffic will bear; letter post, comparing cost of delivery to a cottage on Dartmoor and within a short radius of the post office; telegraph, with block step tariff; and the telephone, with its compulsory two-part tariff. All these methods of charging, says the author, are based on averages. Electricity two-part tariffs are based on rateable value, size of premises, number of lighting points, wattage of lamps and number of inhabited rooms. Why not, then, select the one method with the greatest number of good points?

Mr. Purse was a member of the committee of the Electricity Commissioners appointed in 1929 "to consider the various kinds of charges and tariffs. . . ." He had operated a rateable-value tariff previously, and at that time he was operating a number-of-points tariff. He was converted to the size-of-house tariff and subsequent experience encourages him to press for this one to the exclusion of all the others.

Criticisms of some of the other two-part tariffs are that rateable value increases the difficulty of adopting a uniform charge over a large area that deciding what are inhabited rooms leads to disputes with consumers and internal inspection, and that lighting-points and lamps-wattage bases tend to restrict the use of electricity. In Mr. Purse's district, where five undertakings have been merged and one fixed charge adopted throughout, had a rateable-value tariff been adopted the fixed charge would have had to be varied for each locality. It is contended that with the same average illumination and the same number of occupants the consumption will increase roughly proportionately with the size of the house.

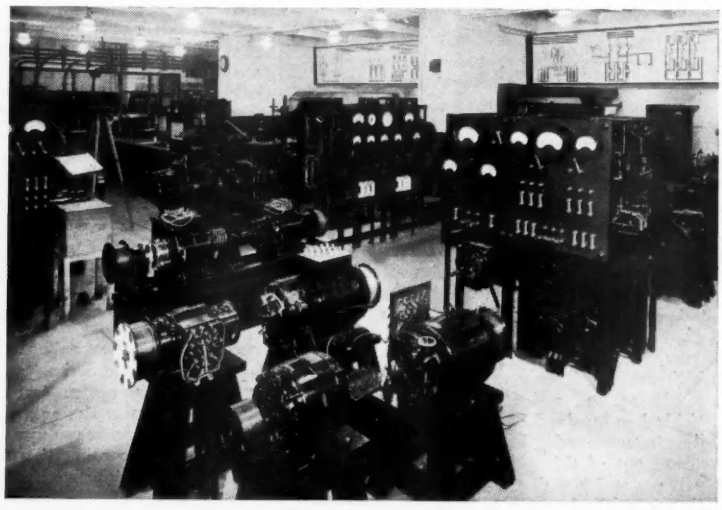
It is emphasised that particular classes of apparatus must be available on hire and hire-purchase terms to take full advantge of a suitable two-part tariff. While cookers and water heaters are suitable for hiring because of their high consumption in relation to cost, refrigerators, because of their low consumption in relation to cost, are recommended for hire-purchase disposal.

A warning is given about the electric fire. If this is encouraged by attractive terms of long-period payment it may be installed too freely and used only for emergency cold "snaps," with disastrous financial results to the electricity supply undertaking.

Television Principles.—The object of the paper, written for a non-specialist audience, which Prof. G. W. O. Howe read before the INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND on December 15th was to explain the principles of television so that the reasons for its slow development might be understood. According to Dr. Howe the mechanical disc method of scanning at the receiver must now be regarded as obsolete; it has been entirely replaced, he says, by the cathode-ray tube.

Improved Facilities for Electrical Education

THE commemoration of the jubilee of the Regent Street Polytechnic School of Engineering, London, W.1, on December 10th was chosen as the occasion for the official opening of the newly equipped Electrical Machinery Laboratory. Before performing the ceremony, Sir Henry Pelham, permanent secretary to the Board of Education, who deputised for the Rt. Hon. Oliver Stanley, president of the Board, commended the Polytechnic for keeping abreast of the times. With regard to evening classes, he said that they must remain a valuable and essential part of the school's work, but he hoped that employers would realise the advantages that accrued both to them and their employés by providing facilities for a certain amount of day study. If he is to get in the forefront the employer must possess a staff of men scientifically trained to take advantage of new developments. Mr. Philip Kemp, head of the school, said that the average number of students was 130, and since 1921 there had been 58 successes in the London University B.Sc. Degree in Engineering; of these 38 had been obtained in the last four years. The function was presided over by Sir Kynaston Studd, president of the Polytechnic.



A portion of the newly equipped electrical machinery laboratory at the Regent Street Polytechnic, London

Energy for the newly equipped laboratory is taken from the St. Marylebone Electricity Department's mains at 415/240 V, 3-phase, 50-cycles, a.c., the experimental machines and circuits being supplied at 100 V from three 20-kVA Johnson & Phillips delta/interconnected-star transformers provided with primary tappings and equipped with series boosters and auxiliary regulating transformers with on-load tap-changing gear, two Mather & Platt 15-kW compound-wound, reactance controlled rotary convertors and a 540-Ah Tudor accumulator. The new equipment, which has cost about £3,000, also includes a representative collection of modern a.c. and d.c. motors and generators (B.T.H., Electro-Dynamic, Lancashire Dynamo and Crypto, Century, Metro-Vick. and Mather & Platt), rotary convertors (B.T.H.), and two mercury arc rectifiers (Hewittic), both of which have been designed with a view to facilitating experimental work, special attention having been paid to convenience of wave form delineation by the aid of cathode-ray oscillographs.

For the purpose of measuring load phase angles and for wave form delineation every synchronous machine in the laboratory, including the rotary convertors, has been equipped with a Joubert contact wheel. All the a.c. motors are equipped with search coils in the stator and in certain cases in the rotor slots also, while the d.c. generators and rotary convertors have search coils at selected positions on both the main end interpoles. The convertors have thermo-couples in the main pole windings at varying depths.

The lighting fittings (supplied by the Curtis Lighting Co. of Great Britain, Ltd.) give a very uniform and almost shadowless illumination. Reflectors for local illumination and for the control panel diagrams were supplied by Holophane, Ltd.

Fifty Years of Contracting

THE ELECTRICAL REVIEW pleasurably associates itself with the many other representatives of the electrical industry in congratulating a company on its present high rank among electrical contracting organisations, resulting from fifty years of hard pioneering and development work. We refer to Messrs. Drake & Gorham, Ltd., and the expression is voiced at this particular moment because of the dinner given by the company in London this week to celebrate the 50th anniversary of its inauguration.

The late Mr. B. M. Drake left school at the age of nineteen and went as a pupil to Sir Joseph Whitworth, of Manchester, where he spent four years training as a mechanical fitter. At the end of that period he saw the future of electricity and joined the Brush Company, and was responsible for the first electrical installation in Madrid. By the time the late Mr. Drake was twenty-five he was managing engineer of both the Midland Brush and the Great Western Brush Co., and was in charge of their early central stations at Bristol, Cardiff, and Cleethorpes. In 1884 he left them and joined the Electrical Power Storage Co., with which company he investigated and discovered that the reason why batteries at that time had a maximum life of a few months only was that instructions had been given that overcharging was on no account to be indulged in for fear of dissolving the plates altogether. Experiment showed that overcharging had no perceptible effect, due to the protective coat which was formed, and he therefore reversed all the previous instructions. Batteries began to last and the company began to make a profit. He was assisted in his experiments by Mr. J. M. Gorham, who joined him as partner and helped him with the early experimental work which was required to make possible the electric lighting of houses on a commercial scale. One of the earliest oil-engine installations was carried out in the firm's offices in Victoria Street. The partnership became a company in 1901.

A theme which ran through the speeches was the value of good personal relations between employer and employé, and one of the finest expressions of such good relations that we have ever witnessed was when Mr. Frank Jarrett, secretary of the company, presented silver salvers, suitably inscribed, to both the chairman and Mr. M. G. Drake, managing director, and a leather-covered blotter to Mrs. Bernard Drake (the chairman's mother and, of course, the widow of the late Mr. B. M. Drake, co-founder of the company), whose birthday coincided with the date of the function.

Mr. Jarrett, in referring to the pride with which the staff regarded the company as heading the list of contractors, said that that pride contributed towards upholding the high trading principles of the concern. When the late Mr. Drake was taken from the company there had been some alarm as to what would happen to the staff, but it was soon discovered that the "new broom" recognised that an old staff which had helped to build the business was worth consideration. Acceptance of the gifts rang with a note of genuine affection.

In toasting "The Staff" the chairman paid a tribute to Mr. M. G. Drake who, although now managing director, had held many staff positions in the past and seemed to be regarded by all as a staff member. There were now four members of the staff with over forty years' service and fifteen with over thirty years' service, and an ex-apprentice was now a branch manager. During the whole of the development period of the organisation, which covered the initial use of casing and capping, and the recent introduction of copper tubing, a fundamental principle of the company's working had always been, and still was so, that the best in everything—material, labour, and son on—was not quite good enough.

Mr. R. Wilson (Bobby) Smith was glad the industry had not passed out of the personal stage. The house of Drake & Gorham had the esteem and respect of all sections of the industry, and an endeavour would always be made to deserve the friendship. He read a letter from Lord Hirst, who was unable to attend the function because he was receiving medical treatment at Bath, in which reminiscences of personal contacts with the late Mr. Drake were related.

Mr. E. E. Hoadley (Maidstone) had a very real admiration for D. & G. He recalled the day when a slim young man visited him and offered to help him out of his difficulties with the "Nernst" lamp. That slim young man was Bobby Smith —a friend of all of us. The more this country got electrically minded the more room there would be for such organisations as Drake & Gorham.

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

Engineering Education

I read with interest the remarks of Mr. C. E. Olive, of Drummondville, Canada, in your issue of December 4th. They entirely bear out my observations on the benefit of taking a broad view in training. Too many electrical engineers study only their own pet subject and grow up with their firms. Whilst this may be quite in the best interests of the firms, it is not good for the engineers themselves. They see one side only of a many-sided career, and consequently when they do leave their employment they are entirely at sea with regard to the main issues of the day.

Travelling does broaden the outlook provided the traveller keeps his eyes open. As engineers, it is our duty to keep our eyes open and observe the conditions around us. In many instances electrical engineers are blamed for these conditions, and this should tend to lead them to take an interest in affairs. Each one adds, or ought to add, something to civilisation, which is built up on mutual self help.

Mankind is best served by people doing their own work well and by doing something for the community in which they live. This can be seen exemplified in the number of engineers who lend their assistance in municipal work; but the number is smaller than it might be, due perhaps to the inherent modesty of the engineer. Work outside one's own sphere of daily activities does broaden the mind and tends to inculcate a more tolerant spirit.

Although the engineer who has travelled should have a broad outlook, this is, unfortunately, not always the case, as the circumstances in which he finds himself do not allow of scope for social work. He is often among coloured races, where every humble task is performed for him.

When his term of work abroad is through he finds that employers of labour are usually chary of engaging him, not because of his lack of experience or knowledge, but because he is not accustomed to the conditions of home employment. His technical abilities are of no use to him if he has not had a training which will help him to deal with human and business problems. Bullying those under him, as is done sometimes abroad, will only tend to make him unpopular in this country.

I am in complete agreement with Mr. Olive that real success comes to those who have had a good training in human and business problems.

D. MACLAREN CATHCART, B.Sc., A.M.I.E.E.

Saltcoats, *December 8th.*

Solving the Unused-capacity Problem

I was extremely interested to read the letter from Mr. G. Wilkinson in your issue of December 4th and entirely agree with him that a great deal more could be done to dispose of electrical energy for certain purposes. In my own house, I have low loading electric fires which can give me all the heat I require with a maximum loading of 1,250 W. During the very cold weather it is necessary to heat the air to about 55 deg. F. if really comfortable conditions are to be obtained. I have attempted to do this by means of tubular heaters thermostatically controlled, but at ¾d. per kWh the cost is excessive. It would make very little difference to me if the heaters were cut out of circuit for a period of four hours each day as I have ascertained by experiment. Therefore, I should be prepared to take a supply under service B and should require about 3,000 kWh of additional energy for space heating purposes alone each year.

At the moment I am hand controlling about 3 kW of tubular heating which is used chiefly during the evenings and only on very cold days. Even at ¾d. per kWh this load cannot be a very profitable one to the supply authority.

The estimated consumption given above does not nearly cover the amount of energy I should require to keep every room in the house at a minimum temperature of, say, 55 or 60 deg. F., which I should like to do, and should do, if energy were available at a cost which would make it a reasonable proposition.

A scene from "9.45," recently presented by the Lancashire Electric Power Co.'s Dramatic Society at Manchester (see page 865)

If I were able to maintain the air temperature at 60 deg. or at least 55 deg. F. the maximum loading I should require for the local radiant heaters would be 750 W. Even with this loading there would be sufficient heat for the carry over period when the air heaters were out of circuit.

Ewell, *December 13th.* J. RUSSELL HICKMOTT.

Fire Risks

Your data showing that 11 per cent. of the fires attended by the Liverpool Salvage Corps last year were caused by electrical faults makes one think fairly deeply, because there appears to be nothing done about it. Undertakings test new services but they do not generally check up on old ones.

I think that the time has come when we should have a Marketing Board to control prices of installation work, to prevent the selling of cheap cable through local multiple stores, to impose penalties for the addition of points on a system until they have been approved by the undertaking, to prevent any person selling or installing (either as contractor or otherwise) any article until it has been approved by the officer of the undertaking, and to prevent the opening of any business by anybody until it can be proved that he has served a full apprenticeship in some branch of the business.

Let's clean up the industry—we are electrical engineers—not fire bugs. H. SCOTT.

Hove, *December 14th.*

Curious Effects of a Wrong Connection

I should be very glad to have your readers' views on the following problem.

Quite recently, a new power installation (230 V, a.c., 50 cycles) was tested for earth resistance and continuity and left ready for connection. The job was carried out in tubing, with 250-V, 15-A, d.p., three-pin interlocking flush switchplugs fitted at the termination of the sub-circuits.

On being recalled to this job to attend to an alleged faulty plug I found, in addition to signs of the amateur electrician's work, that whenever this switchplug was turned off a loud report and a large flash came from behind the metal front plate, blowing the local fuse, although, in switching on, the fire heated up normally. The three-pin plug had been connected to a 2-kW fire by the consumer. The live wire in the

flex to the fire was connected to the correct live pin in the plug top but the neutral wire from the fire was connected to the earth pin, the earth wire from the fire being taken to the neutral pin. This made the switch into a single pole type, as the current was returned *via* earth pin to front plate, switch arm, and to the steel conduit, not to the neutral wire.

The trouble was soon remedied, but I should appreciate any suggestions as to the cause of the apparently high voltage (perhaps due to some transformer or inductive effect?) on opening the switch. The arc was about 4 in. and had severely burnt the plug interior.

A demonstration before various parties was curtailed owing to snapping sounds coming from beneath the floor boards of a house in a different district. On examination I found that whenever the plug under test was switched off a spark jumped from the steel tube to a main water pipe about half an inch away—and had burnt a large hole in the lead.

The system was earthed in the basement, but at a point where the jumping was taking place I firmly bonded the conduit and water pipe. This effected a local cure, but the experiment was abandoned completely when four floors away sparks of an apparently high-frequency nature were observed jumping to a hot-water pipe. It would be interesting to hear opinions on this also, as a wrong plug connection can seemingly have far-reaching results. H. TAYLOR.

London, W.14, *December 14th.*

Grossly Exaggerated

A propos the recent correspondence regarding chief engineer's salaries and the small salaries paid to chief engineers controlling undertakings with relatively large outputs, surely the record has now been achieved by the offer in your advertisement pages of a salary of £650 a year for an output which is stated to be 1,698 million units.

It is satisfactory to note that an offer is made to pay the I.M.E.A. schedule rate in two years' time.

E. A. LOGAN,

December 12th. *Electrical Engineer*, Erith U.D.C.

[In the Barnstaple advertisement, to which Mr. Logan refers, our printers substituted a comma for a decimal point; the output is 1.698 million units. Therefore, the position is not so bad as it was made to appear.—EDS., ELEC. REV.]

Are We Engineers?

In his inaugural address as chairman of the Wireless Section of the Institution of Electrical Engineers Dr. E. Mallett chose as his subject "The Education of a Communications Engineer." In this he regretted that no definite means existed in this country whereby a radio or communications engineer could be distinguished from the unqualified practitioner. I would submit, however, that associate membership of the Institution of Electrical Engineers, especially when obtained by its own examination with specialisation in radio and high-frequency engineering, provides the requisite status.

To obtain exemption from the graduateship examination it is, I believe, essential to possess at least a Higher National Certificate, or preferably a university degree in engineering, while for associate membership further requirements as to experience are necessary. Surely it is justifiable then to assume that the Institution examination is at least the equivalent of these other qualifications, while associate membership should take precedence? For certain posts, such as higher research work, it is not so recognised as adequate, but I suggest that people so engaged are scientific physicists rather than engineers.

Dr. Mallett appeared to suggest that his communication engineers would work on a higher plane than mere mechanical engineers, but it is well known that chaos and cost may occur in a large concern owing to lack of practical engineering experience.

Dr. Mallett blames our old system of training for the fact that the majority of new ideas, and master patents, have come from abroad (mainly America and Germany), but surely it is not so much our lack of either training or genius, but rather that British sluggishness, emphasised by Dr. Mallett himself, which withholds the finance necessary for their successful development.

Even if one admits his hypothesis, however, it may well be that, although the initial possibilities of successful new ideas are often sufficiently demonstrated by other countries to rouse the interest of our financiers, it is more often than not that engineers are left to sort out the "trumpet blowing" from the genuine possibilities and develop a product which often greatly excels that of its country of origin. British equipment such as that for broadcasting, television, speech-input, recording, although lacking sometimes in multiplicity of design to suit every requirement—particularly financial ones—is without question regarded in most countries as a model of reliable modern practice.

Dr. Mallett's deprecation of the teaching of modern languages is astounding, especially as he himself appears to think that we have so much to learn from foreign countries. To one who has travelled abroad there is not the slightest doubt that at least a working knowledge of French, German or Spanish is one of the engineers' greatest assets. Dr. Mallett may be right as regards the correct form of education for his specialised physicist of the future, but one doubts the adequacy of the curriculum as applied to engineers as such, whose job it will be to redesign the equipment for practical operation and with whom the Institution should be mainly concerned.

Might it be suggested that before modifying the existing methods and ideals of engineering education an endeavour should be made to obtain recognition by all concerned of the one and only qualification which should form the entree to professional status and recognition as a sound and capable engineer, *viz.*, corporate membership of the Institution of Electrical Engineers.

December 14th. LOGIC.

Planning Electricity Showrooms

THE desirability of permitting the actual salesmen to have a say in the planning of electricity showrooms was emphasised by Mr. V. W. Dale, business manager of the British Electrical Development Association, in a lecture to the London Local Group of the Electrical Power Engineers' Association at Caxton Hall, Westminster, last Tuesday.

In view of the scope of the work undertaken by the electricity showroom, Mr. Dale considered that a more appropriate name was necessary and suggested "electrical service centre" or "electrical sales centre." Domestic electrical appliances having reached their present stage of efficiency, supply authorities must appreciate what a highly important function lay with them in the direction of extending the benefits of electricity to the greatest number of people at the lowest possible price, and what a vital factor the showrooms were in electrical development.

After stressing the importance of choosing a suitable site in the shopping thoroughfare, Mr. Dale said that facilities should be such as to enable fittings to be incorporated as a part of the decorative scheme. He strongly favoured sectionalisation, and thought that adequate space should be provided for the display of apparatus as such, quite apart from demonstrations of its applications. Both demonstration and interviewing rooms were necessary if full advantage was to be taken of electricity.

Although there were, of course, questions of site, local conditions, etc., certain fundamental principles could be applied to showrooms of all sizes. There was a considerable difference of opinion regarding windows, but he was definitely in favour of the open type, since it allowed the whole of the ground floor to become a show window. However, in both the typical layouts he put forward (for small and large sites) he had introduced a compromise between the open and closed type.

The position of the pay counter should necessitate customers passing through the showrooms, and it should be possible to demonstrate every principal type of apparatus in the main showroom, since for every one person who went upstairs there were ten to twenty who got no farther than the ground floor. Adequate wiring arrangements were essential in order to facilitate alterations and to obviate risk of failures due to overload.

Electricity showroom windows, on account of their lighting facilities, had an advantage not possessed by any others, and there was no tradition to guide displays. Simplicity was necessary, and since electrical equipment was, or should be, designed on modern functional lines it was inevitable that displays would follow a modernistic rather than realistic trend, though there were, of course, particular instances where realistic treatment would be more effective. Ninety per cent. of electricity showrooms to-day could be redesigned to advantage.

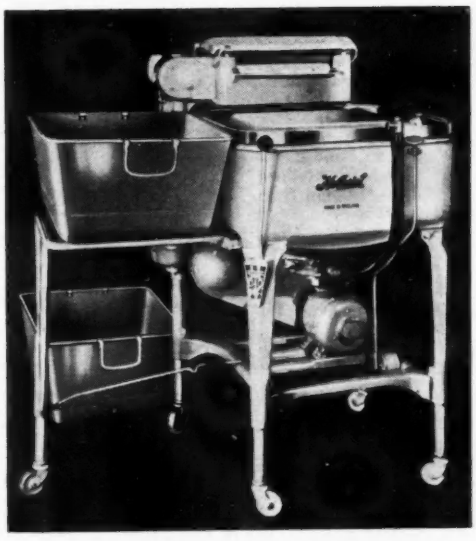
In the discussion which followed Mr. E. Prown (Hackney Electricity Department) said he was against too severe sectionalisation, and suggested that inclusion in a display of a few outside items was desirable and avoided staleness. Mr. G. S. Bone (Ealing Electricity Department) thought the open-type window was more difficult to keep at its best, and that the closed type had more pulling power. The use of oak window back screens which could be let down into the floor when they were not required was put forward as a solution to the window display problem by Mr. R. Stainer (Metesco). Mr. J. P. Morley, hon. secretary of the Group, said that continuous meter reading was an essential factor in showroom management. The chair was taken by Mr. H. Bourne.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Electric Washing Machines

Several improvements have been made in the design of the electric washers of the HOTPOINT ELECTRIC APPLIANCE CO., LTD., 24, Newman Street, London, W.1. The machines, which employ B.T.H. motors, embody, among other features, an improved safety wringer and complete rinsing equipment, the tubs for which are carried on a bracket support attached to the washing machine. This support is of strong tubular steel construction and can be fitted either to the back or the left-hand side of the machine. When open it is quite rigid, being "tied" in position by the horizontal member, which also provides the spring catch to hold it when closed. A castor on the leg allows the machine to be moved even in the extended position.



The latest Hotpoint-B.T.H. washing machine

The principle of the old wringer has been retained, namely, an upper roll of soft rubber and a lower roll of hard rubber, with automatic tensioning. A pressure release mechanism which operates without effort on the part of the operator is incorporated. Two tripping bars run the full length of the wringer. By a simple toggle mechanism only a very small fraction of the roll pressure is imposed on the trip mechanism and the load on the mechanism is substantially independent of the load passing through the wringer. After the pressure has been released the trip may be reset by a single movement without altering the spring setting. The appearance of the wringer has been considerably improved and smooth contours eliminate soap-collecting corners. A constant-mesh gear box has been fitted, giving easy control under heavy loads.

A tap is fitted to the end of the the drain hose, making it possible to stop the flow of water without rehooking the end of the hose on to the top of the bowl. At the same time it is so made that it is impossible to replace the hose on the edge of the bowl without first turning off the tap, thus ensuring that should the hose become detached from the bowl there will be no damage or mess.

The length of cable has been increased to five yards and the third (earth) conductor is in accordance with the latest I.E.E. Regulations. Two cable clips are also now supplied on which the cable may be wound when the machine is not in use.

Domestic Laundry Equipment

Following the success of the "Crosley" refrigerators, A. J. BALCOMBE, LTD., 52, Tabernacle Street, London, E.C.2, are introducing electric washing machines and an ironer made by the same manufacturers. Apart from slight improvements in the casters and chassis and the incorporation of a new "streamlined" wringer with a soft black rubber top roller and a hard white rubber bottom roller (instead of two semi-balloon rollers), the *de luxe* "Savamaid Model 62" is almost identical with the standard "Model 61."

Both types are constructed of heavy pressed steel (14 gauge) and, although very compact, have an extra deep base. The four legs are heavily bossed and substantially braced. They are mounted to the frame of the machine with rubber cushioned inserts.

Measuring 22 in. by 14 in., the round tub has a capacity of 8 lb. of dry clothes, is vitreous porcelain enamelled inside and out, and is mounted on heavy rubber gaskets eliminating all possibility of staining. A rubber-cushioned edge is also provided on the lid, which is light and easily lifted.

Particular attention has been paid to ensure quickness of operation. The ¼-h.p. motor, which is fitted with a radio interference suppressor, is connected direct to the agitator, which is of aluminium and fitted with a positive push-pull control clutch conveniently situated at the top. A new type of finger release under the fin permits easy removal of the agitator for cleaning. Two finishes are available, namely, mottled green and sand. The net weight is 156 lb. Pumps can be fitted if desired.

The "Spe-dry Model 64" is similar to the machines already described, but instead of a wringer a centrifugal dryer is fitted. The spinner tub is of plain design equipped with an aluminium swivel draining board and, like the washer tub, is mounted on black rubber gaskets to obviate stains. Single lever control is provided together with cushion braking. A centrifugal pump with cut-off control serves both the washing and spinning tubs.

There are only five moving parts in the "Savamaid Model 60" ironer, the design eliminating the necessity for cam trip mechanism, brake shoes, controlling springs, &c. The ironer roll is driven by a fully floating shaft and is supported on an exceptionally heavy steel tube. Elliptic spring mounting of the ironer shoe equalises pressure. The direct-drive motor is of ⅓ h.p. and the double switch controlling the motor and shoe heat is fitted with a pilot light.

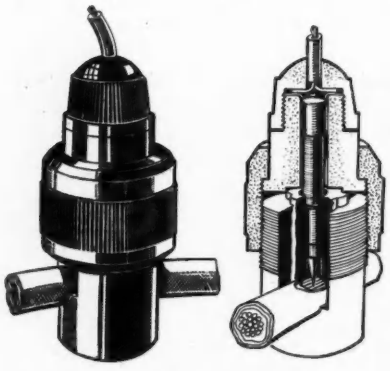
The recently introduced "Crosley" 64 and 60 washers and the No. 62 ironer

H.F. Low Impedance Feeder

A feeder has been designed by BELLING & LEE, LTD., Cambridge Arterial Road, Enfield, for conveying h.f. currents to or from half-wave dipole aerials in which the feed is taken at the centre of the aerial. Under these conditions the radiation resistance referred to the centre of the aerial is theoretically 73 ohms in free space and slightly greater in practice. This feeder has been designed mainly for reception purposes with particular reference to the television frequencies. The specification is: Surge impedance 75 ohms. Loss in db. per 100 ft. at 45 m.c.=1.4; 14 m.c.=0.8.; 7 m.c.=0.6. Two enamelled copper conductors each 0.018 in. dia. Spacing between centres 0.035 in. Covering, Telconax laid up to a final elliptical section 0.1 in. by 0.15 in. Weight per 100 ft. 0.85 lb., breaking strain 20 lb., conductors breaking first.

A Connector for Tapping Mains

A new type of connector has been designed by RICH AND PATTISON, LTD., 68, Edgbaston Street, for the rapid tapping of mains to take off a small cable such as 3/.036.

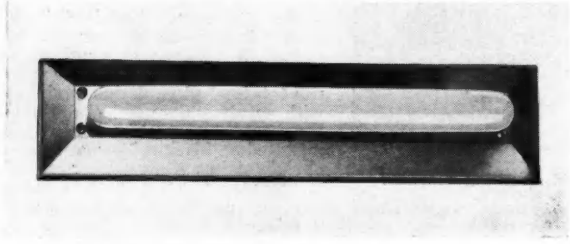


The Rich and Pattison connector

The accompanying sketch shows the construction of the connector, which is of bakelite. By screwing down the cap the cartridge fuse is made to bear against the subsidiary cable at one end and against a pointed metal plunger at the other end. As the body of the holder is screwed up the point is driven into the cable thereby completing the circuit to the subsidiary cable. Complete assembly and connecting up take less than thirty seconds. The design has been passed by the Home Office.

Domestic Wall Bracket

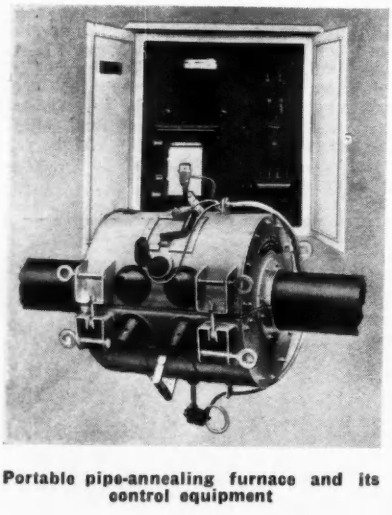
A new type of domestic wall unit specially designed for use with "Maxtrip 2" side contact tubular lamps in opal or colour-sprayed finish is being manufactured by STRAIGHT-LITE REFLECTORS, LTD., 73, Canonbury Road, London, N.1. Though plainly constructed, this unit (No. 804) is decorative in appearance and can be supplied in colours to suit customers' requirements, the standard finish, however, being chromium.



The Straight-Lite No. 804 domestic wall unit

A Portable Electric Furnace

To overcome the difficulty of normalising welded pipe joints, especially where the pipes have been fitted and welded into their ultimate positions, METALELECTRIC FURNACES, LTD., Cornwall Road, Smethwick, have produced a portable electric joint annealing furnace. It is cylindrical in shape, made in halves, and fitted with suitable locking arrangements, so that the two hearths of the furnace can be clamped around the joints to be heat treated. Handles are provided for lifting, and loose distance rings are arranged to suit the diameter of the pipe under treatment, so that various sizes of pipes can be heat treated. The rings are split to ensure the furnace being concentric to the outside diameter of any size of pipe within a given range. The furnace is heavily insulated and, to conform with the split rings, different diameter insulating refractories can be used to minimise heat losses. The working temperature of the furnace is 600/650 deg. C., and the control of this is effected by instruments housed in a special portable steel-plate case provided with lifting lugs. The heating elements are made of heavy nickel-chrome strip. Accurate control is ensured by a series of holes through which search couples can be linked to a recorder, so that the actual temperature of the pipe under treatment is recorded throughout the whole treatment period.

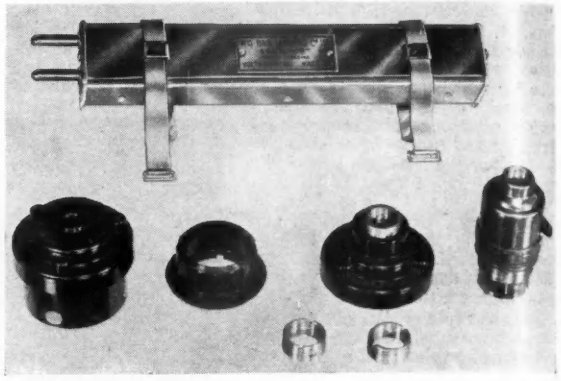


Portable pipe-annealing furnace and its control equipment

The furnace will withstand the rough handling demanded by transportation from site to site, and special care has been given to housing and fixing the controller and recording instruments.

An Anti-freezing Device

For the prevention of burst water-pipes the WO-BAR MANUFACTURING CO., LTD., 69a, Shakespeare Street, Southport, has introduced the "Anti-Freezer." It is designed for fastening to the water pipe, about 4 ft. from the cistern, by means of two aluminium straps and can also be used for attaching to a car radiator, to prevent windows steaming, &c. It has a loading of 75 W.



The "Wo-Bar" anti-freezer (above) and the Francis locking lampholder for Edison screw lamps, together with new conduit fitting top and bushes. Extreme right: The new Lighting Trades lampholder

A Combined Switch and Lampholder

We have just received from LIGHTING TRADES, LTD., and the WELBACH LIGHT CO., LTD., 51-55, Garratt Lane, Wandsworth, London, S.W.18, a sample of a new type of combined switch and lampholder for the sale of which in this country they hold the sole patent rights. Substantially constructed of brass, the switch-lampholder is available in a wide range of finishes, and the switch action, which can be operated by one hand, is particularly good and compares favourably with key or push-bar pattern holders already on the market.

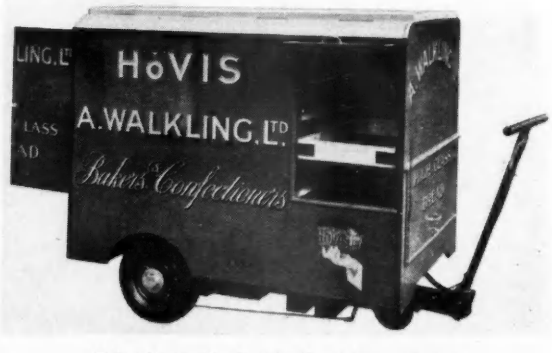
A Locking Lampholder for Conduit Fitting

As a further development of their all-bakelite locking lampholder for Edison-screw lamps (ELEC. REV., May 1st, 1936, page 642) FRANCIS LAMP LOCKS, LTD., 2-4, Cockspur Street, London, S.W.1, are now supplying it with a cap designed to screw straight on to conduit. The basic thread is ¾ in. electrical thread (conduit), but bushes are provided free of charge to take ⅝-in. e.t., and ⅜-in. and ½-in. brass threads.

An Electric Handcart

The latest development by ELECTRIC VANS, LTD., 14/16, The Colonnade, Guilford Street, London, W.C.1, is an electric handcart. The cart, which is of the 4-cwt. size, is driven by a totally enclosed 12-V motor through a flexible drive which eliminates the differential, resistance and normal control gear, and enables the motor to work up to 250 r.p.m. before taking up its load. The battery consists of two 6-V tractor batteries in series and gives a distance of about 8½ miles per charge.

Control is from the left handlebar, and a safety switch cuts off the supply when the vehicle is left unattended, to guard against unauthorised interference. The 7-in. self-locking internal expanding brakes operate on the balloon-tyred wheels. The batteries are easily removed from the chassis and a special charging device permits re-charging from any power point. The van is 3 ft. 6 in. wide and 5 ft. 7 in. long and can be turned in its own radius; its speed is 4 m.p.h.



"Tomlinson" electrically driven handcart

Argentine Electrical Imports

THE Argentine Government's recently issued annual detailed returns of foreign trade for 1935 appear very opportunely in view of the negotiation of a new Anglo-Argentine commercial agreement. From the returns have been extracted the following figures showing the imports of the principal groups of electrical machinery and apparatus into Argentina during the year, notes of increases or decreases compared with 1934 being added. It should be noted that the total of electrical materials, unspecified, is not strictly comparable with 1934, because new headings are included for imports of heating appliances (163,000 pesos), vacuum cleaners (104,000 pesos) and some minor items not previously given separately. Similarly, some of the figures for cable and wire are not comparable owing to changes in classification. It will be seen that with few exceptions trade has progressed, the only important declines being in underground telephone cables, accumulators and radio sets, the last-named being partly offset by larger purchases of radio parts. The values, which are those adopted by the Argentine Customs, are in paper pesos, worth about 17 to the £.

	1935 Pesos (000).	Inc. or dec. on 1934. (000)
Dynamos and motors—		
Total	1,796	+ 574
From Germany	498	+ 166
„ Belgium	9	+ 4
„ United States	300	+ 180
„ Italy	78	+ 34
„ United Kingdom	368	+ 168
Fan motors—		
Total	170	+ 42
From Germany	34	— 16
„ United States	78	+ 30
„ Italy	3	— 18
„ United Kingdom	10	+ 9
„ Japan	44	+ 35
Accumulators and parts—		
Total	1,410	— 65
From Germany	226	+ 70
„ United States	796	— 194
„ Japan	30	+ 30
„ United Kingdom	120	+ 15
„ Canada	161	+ 11
Batteries—		
Total	1,225	+ 262
From Germany	13	— 11
„ United States	989	+ 202
„ United Kingdom	52	+ 5
„ Denmark	123	+ 21
Ammeters and voltmeters—		
Total	108	+ 32
From Germany	38	+ 12
„ United States	32	+ 10
„ United Kingdom	12	— 4
Radio-telephone apparatus—		
Total	820	— 573
From Germany	38	— 214
„ United States	655	— 397
„ Holland	51	+ 23
Receiving sets—		
Total	2,713	— 247
From Germany	39	+ 1
„ United States	2,144	— 420
„ Hungary	113	+ 37
„ Holland	395	+ 144
„ United Kingdom	22	— 6
Loudspeakers—		
Total	39	+ 2
From United States	33	+ 2
Radio-telephone parts—		
Total	2,880	+ 160
From Germany	410	+ 165
„ United States	1,820	— 100
„ United Kingdom	245	— 5
„ Holland	350	+ 140

	1935 Pesos (000).	Inc. or dec. on 1934 (000).
Telephones—		
Total	403	+ 52
From Sweden	35	+ 18
„ Great Britain	230	— 10
„ Germany	38	+ 22
„ Belgium	76	+ 63
Telephone material—		
Total	715	+ 523
From Germany	37	+ 33
„ Belgium	72	— 28
„ United States	111	+ 79
„ United Kingdom	450	+ 396
Telegraph material—		
Total	92	+ 64
From Germany	80	+ 78
„ United Kingdom	10	— 12
Switches, circuit breakers, cut-outs, fuses, &c.—		
Total	1,160	+ 98
From Germany	800	+ 150
„ United States	104	— 36
„ United Kingdom	80	+ 27
„ Italy	32	— 87
„ Belgium	90	+ 33
Incandescent lamps—		
Total	2,006	— 48
From Germany	223	— 5
„ Belgium	132	— 10
„ United States	80	— 15
„ Japan	535	+ 62
„ Holland	415	— 22
„ United Kingdom	197	+ 23
„ Russia	250	— 30
House-service meters—		
Total	1,485	+ 385
From Germany	795	+ 320
„ Austria	280	+ 197
„ Canada	45	+ 44
„ United States	50	— 350
„ United Kingdom	55	+ 8
„ Switzerland	180	+ 130
Cable and wire, up to 5 mm., not covered with lead or silk—		
Total	1,302	+ 86
From Germany	298	— 228
„ United States	68	— 39
„ United Kingdom	639	+ 260
„ Canada	58	+ 22
Cable and wire, over 5 mm., not covered with lead or silk—		
Total	558	— 117
From Germany	93	— 180
„ United States	41	+ 33
„ United Kingdom	367	+ 81

	1935 Pesos (000).	Inc. or dec. on 1934 (000).
Cable and wire, up to 5 mm., lead-covered—		
Total	125	— 175
From Germany	19	— 183
„ United Kingdom	67	+ 17
„ Sweden	21	— 23
Cable and wire, over 5 mm., lead-covered—		
Total	1,433	+ 336
From Germany	55	— 14
„ Canada	176	+ 159
„ United Kingdom	1,181	+ 207
Other cable and wire, not dutiable—		
Total	176	— 553
From Germany	98	— 33
„ United States	39	— 241
„ United Kingdom	21	— 92
Cable and wire, silk covered—		
Total	52	+ 46
From Germany	10	+ 9
„ United States	11	+ 10
„ United Kingdom	15	+ 13
Telephone cable, underground—		
Total	2,886	— 1,054
From Germany	1,460	— 1,570
„ Czechoslovakia	190	+ 190
„ Italy	313	+ 173
„ Holland	269	+ 26
„ United Kingdom	182	— 263
„ Sweden	215	+ 146
Telephone cables of iron or steel, covered—		
Total	232	— 91
From Canada	159	— 2
„ Norway	72	— 87
Accessories for underground cables—		
Total	95	— 100
From Germany	80	+ 17
Insulating tape—		
Total	216	— 117
From Germany	20	— 13
„ United States	78	— 50
„ United Kingdom	73	— 2
„ Japan	9	— 49
Insulating tubes—		
Total	1,007	+ 313
From Germany	700	+ 200
„ United States	78	+ 38
„ United Kingdom	213	+ 73
Electrical materials, unspecified—		
Total	1,810	— 150
From Germany	720	+ 75
„ United States	480	— 150
„ France	40	+ 10
„ Italy	20	— 150
„ United Kingdom	240	+ 90
„ Sweden	40	— 40
„ Switzerland	103	— 17

New Books

Accumulator Charging, Maintenance and Repair. By W. S. IBBETSON. Pp. 151; figs. 41. London: Sir Isaac Pitman & Sons. Price 3s. 6d.

Accumulator charging is generally considered to be an unwholesome process, and in consequence too little care is frequently expended upon it. That a lack of care to put the work upon its really simple engineering basis is frequently the real source of its unwholesomeness is widely overlooked.

There has always existed a certain degree of mystery about accumulator charging. This book, however, is a sound and safe antidote to this complaint. In its fifth edition it has been brought up to date as a text-book for motor electricians and all who are in any way connected with accumulator charging. It is a practical handbook covering all aspects and is written in such a way that little technical knowledge is needed to understand it, while the well-produced explanatory diagrams give further assistance. The new edition contains a chapter on country house and emergency battery installations, the number of which has been increasing rapidly in recent years, so that the book should now reach out to another important class of accumulator user not previously catered for specifically.

A description of constant-potential or compensated-voltage control methods of accumulator charging should have been included. Voltage-controlled methods are tending towards almost universal use in motor cars at the present time, so that notes on their peculiarities as affecting accumulators would be very useful. The " hints and precautions " section cannot be considered quite complete unless prominence is given to lead poisoning. Too much attention cannot be paid by charging operators to this danger, which, too often, is disregarded, perhaps because the penalty is not necessarily lead poisoning, but tuberculosis! These criticisms apart, the book can be recommended as a leading handbook on the practical aspect of accumulator charging.

Power Wiring Diagrams. By A. T. DOVER. Pp. 216; figs. 272. London: Sir Isaac Pitman & Sons. Price 6s.

This useful handbook of diagrams showing the connections of all the more usual control and protective systems has now reached its third edition. The author, as head of the Electrical Department in Battersea Polytechnic, is well placed for judging the real needs of practical men who have to erect and care for electrical machines and switchgear. The book is likely to prove a valuable time-saver, as reference to the type of circuit required is made easy, and each clear diagram is accompanied by a compact description of the essentials. A welcome addition to the line drawings is an appendix with reproductions of photographs of some of the newer control pillars and starters, which must serve to give confidence to the repair man approaching unfamiliar appliances.

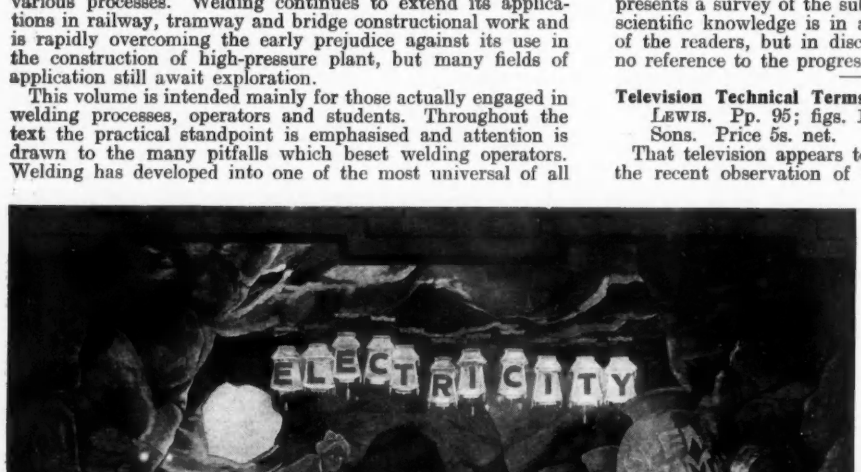
In this thoroughly revised edition the a.c. section has grown to be the most extensive, and entirely new sections are devoted to welding and rectifiers. The tables, curves and data furnished are sufficient for all normal erection, repair or resetting requirements, and the work is to be commended for restraint in its representative selection from the mass of manufacturers' drawings.

Intended chiefly for those concerned with industrial plants, the handbook is one which should be well within reach of all those associated with the control gear or connections of electrical machines. Although comprehensive and containing more than 270 illustrations, the book is still of convenient pocket size.

Electric Arc and Oxy-acetylene Welding. By E. A. ATKINS and A. G. WALKER (Third edition). Pp. 394; figs. 178. London: Sir Isaac Pitman and Sons. Price 8s. 6d. net.

The appearance of a third edition of this work reflects the progress during recent years in the technique of welding by various processes. Welding continues to extend its applications in railway, tramway and bridge constructional work and is rapidly overcoming the early prejudice against its use in the construction of high-pressure plant, but many fields of application still await exploration.

This volume is intended mainly for those actually engaged in welding processes, operators and students. Throughout the text the practical standpoint is emphasised and attention is drawn to the many pitfalls which beset welding operators. Welding has developed into one of the most universal of all metallurgical processes, and among the outstanding developments in recent years are its wide applications for the building up of heavy plate and bar structures, thus avoiding heavy and costly castings, in machinery repair work and in shipbuilding constructional work. Gases of high purity are now utilised, the twin-jet blow pipe is being used for heavy work thus speeding up production, and shielded arc and atomic hydrogen methods of welding are making great strides. Aluminium can now be electrically welded by using specially coated aluminium wire electrodes. This edition maintains the high standard of the earlier editions as a valuable book of reference.



[Elec. Rev. photo

Ali Baba and the Forty Thieves—an attractive Christmas display at the showrooms of the Hackney Electricity Department

Everyday Science. By A. W. HASLETT. Pp. 354. London: G. Bell & Sons, Ltd. Price 7s. 6d.

This book deals with the minor problems of science in a popular manner, from food production to Diesel engines and mercury-vapour turbines. It contains a good deal of information that can be commended to the attention of those who are called upon to explain to the layman in simple terms the practical applications of electricity. The elements of refrigeration, air-conditioning, heating, light sources and small electric motors are dealt with in a manner that should provide inspiration for lecturers on why as well as how electricity can be used to improve standards of living.

Those interested in the detection of crime can read of the way in which X-rays and ultra-violet and infra-red rays are pressed into service. A chapter on the "Problems of Waste" presents a survey of the subject likely to interest many whose scientific knowledge is in advance of that assumed for most of the readers, but in discussing railways the author makes no reference to the progress of electrification.

Television Technical Terms and Definitions. By E. J. G. LEWIS. Pp. 95; figs. 13. London: Sir Isaac Pitman & Sons. Price 5s. net.

That television appears to have a language of its own was the recent observation of an ordinary man on overhearing an earnest discussion between two enthusiastic technicians. He might well be excused for so thinking if he heard them digressing on, say, the "dissector multiplier for the drift method."

The majority of technical expressions used in television are probably self-explanatory, given both the time to think out their logical application as well as a working knowledge of the various systems that have attained any measure of success. Here is a book that may save much effort, for it makes reasonably clear by its definitions some thousand terms so used.

In not a few instances the explanations rank with what *Punch* terms "a glimpse of the obvious," and American idioms are not wholly absent. There is circumlocution, too, in the several uses of the expression "a right line" leading at last to the definition for this expression itself as "a straight line," the use of which would have made all clear from the start. Few mistakes are noticeable apart from the discrepancy between the definitions for "neon lamp" and "extinguishing voltage." The diagrams and more technical definitions are good and sufficiently complete to an understanding reader.

The book is of most use to the novice, but it also provides a handy means of reference for technicians should they, for instance, forget the precise cause of a "squegging oscillator" or desire accurately to enlighten a friend who quite wrongly thinks that "origin distortion" must perforce be the entire fault of the B.B.C. transmission. The author wisely reserves fifteen blank pages at the end of the book, where one can make a note of additional terms brought into use as the science develops.

Shorter Notices

"Copper and Bronze Welding," by W. L. Kilburn (Pp. 156, price 5s.), is produced by the British Oxygen Co., Ltd., London, and provides reliable information on the welding of tube and sheet copper for piping installations and roof work. All aspects of the subject are dealt with in a manner which will appeal to the practical man and the authoritative information should popularise the adoption of welded light gauge copper installations.

In the Courts

A Defective Lamp Installation

Frederick Braby & Co., Ltd., Glasgow, were fined £15 at Hamilton, on December 9th, when Sheriff Norman Walker issued his judgment in respect of an alleged contravention of the Factories and Workshops Act, 1901. The charge was that at Nethan Wrought Iron Works, Motherwell, they neglected to observe Regulation I of the Factories and Workshops Act inasmuch as an overhead screw cap lighting fitting and shade attached to a wooden support fixed to a corrugated iron building, which was handled by a workman, was not so constructed and maintained as to prevent danger. As a result an employé suffered an electric shock and received injuries from which he died.

An alternative charge was that respondents failed to comply with the regulation in respect that the apparatus was not so constructed and maintained as to prevent danger as far as was reasonably practicable. When the respondents intimated that they were willing to plead guilty to the alternative charge, the Factory Inspector declined to accept this plea.

From the evidence it appeared that the light failed and the workman climbed on to the roof to insert a new lamp. While doing so he received a shock and fell from the roof and subsequently died from his injuries. The fittings of the light, it was alleged, had not been property adjusted. The Sheriff found respondents guilty of the charge of neglecting to observe the regulations.

Ownership of Meter Patents

In the Chancery Division on December 11th Mr. Justice Bennett concluded the hearing of a friendly dispute between Measurement, Ltd., and La Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz as to the construction of an agreement dated March 16th, 1921. The French company owned a number of patents for the manufacture of water and electricity meters, and Measurement, Ltd., was incorporated to exploit the patents in the British Empire. The duration of the agreement was for a term of twenty years, expiring in 1941. The question now for decision was whether the patents for the British Empire were transferred absolutely to the English company or whether, at the expiration of the agreement, they had to be transferred to the French company.

His Lordship held that the letters patent remained the property of the French company and that the English company was entitled to the exclusive benefit and advantage of them during the continuance of the agreement.

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

Compensation for Displaced Men

Thirty-five men displaced as a result of grid operations received a total of £8,000 as compensation from their former employers, the North Eastern Electric Supply Co., at a luncheon held in Newcastle recently. The men, whose ages ranged from about 40 to 70 years, received amounts varying from £70 to £492 each. The compensation was the result of an agreement between the employers, and the National Union of General and Municipal Workers. Mr. H. A. Couves (general manager) was among those who represented the N.E.S. Co., and Mr. George P. Dean and others represented the Union.

Registered Electrical Contractors

At the last meeting of the Executive Committee of the National Register of Electrical Installation Contractors the following applications for registration were accepted :—

C. H. Bunn, Edgeley, Stockport.
T. Wm. D. Bruce, York.
F. Chennell, Capel, Surrey.
Albert Electric Co., Ltd., Deansgate, Manchester.
H. E. Hawley, Stoke-on-Trent.
Torbay Electric, Ltd., Torquay.
J. S. Denholm, Glasgow, S.1.
W. & H. Nelson, Ltd., Bellshill, near Glasgow.
J. Edward, Glasgow, C.4.
C. W. Seth (trading as A. W. Seth), Hayes.
J. F. Foggo, Ltd., Edinburgh, 2.
A. H. Morris, Westhoughton, near Bolton.
J. T. Southwood, Mutley, Plymouth.

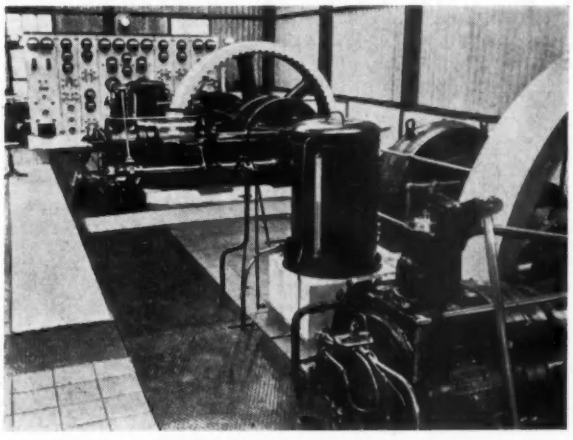
At the same meeting one application was withdrawn and fourteen were declined.

The West Middlesex Sewage Works

In our last issue we described the electrical plant installed at the West Middlesex Sewage Works, Twickenham. The building, which was on modern architectural lines, called for treatment which was entirely different from the accepted industrial lighting practice. Special fittings were designed which incorporated reflectors of Holophane prismatic heavy-duty type. The interior of the building is finished in white glazed brick with large areas of lay lights which give the maximum lighting effect by daylight. With such a high standard of daylight it is important that the artificial lighting shall support these conditions by night, and the lighting scheme required careful planning to ensure the highest efficiency and intensity commensurate with economical operation. The æsthetic requirements of the interior architectural design necessitated fittings of special design. The compressor house, which is 330 ft. long by 68 ft. wide and 40 ft. high, is lighted by rectangular pendant box fittings suspended on down rods with sides glazed to match the ceiling laylight. The units incorporate two 500 W concentrating type Holophane heavy duty reflectors. The total number of units in this building being forty-eight. The pumping station, which is 150 ft. long by 50 ft. wide, has a similar fitting to that used in the compressor house, fifteen such fittings being used here. The switchboard annexe has three rectangular box fittings each equipped with a two 300 W lamps. The workshop is equipped with 500-W Holophane heavy duty units in three rows. A large number of Holophane rectangular bulkhead and "Widerlite" units are used throughout the buildings.

An Industrial Power Plant

The accompanying illustration shows the power house at the works of Vulcanised Fibre, Ltd., Guildford, which has recently been completed. The plant has an output of over 100 kW at 200 V d.c., 200 A. The dynamos installed are by Lancashire



The power house of Vulcanised Fibre, Ltd., Guildford

Dynamo & Crypto, Ltd., and Mather & Platt, Ltd., and the semi-Diesel crude oil type engine was supplied by Ruston & Hornsby, Ltd. The installation was carried out by the engineers of Vulcanised Fibre, Ltd.

Orders Recently Booked

The General Electric Co., Ltd., has been commissioned to supply a complete amplifying system for H.M.S. *Royal Oak*. The system will comprise a 100-W output channel adapted to be fed by a special all-wave radio input by a microphone or by a gramophone pick-up. It will relay to twenty-seven loud speaker points throughout the ship.

The same company has also received an order for a complete radio relay equipment from the Crown Agents for the Colonies in connection with the broadcast relay service established in the Gold Coast Colony. It is for an extension of the system to Koforidua, and the equipment comprises two special short wave receivers with associated power amplifiers

Holophane lighting fittings in the Compressor House of the West Middlesex Sewage Works

for direct operation on the 230 d.c. supply available. Line material and loudspeakers for an initial load of 300 subscribers have been supplied. This order is the fifth of its kind for the Gold Coast Colony and, in all, the G.E.C. has supplied complete equipment for 3,000 subscribers in this Colony.

Fredk. Thomas & Co., Ltd., have received a contract for the manufacture of the electric lighting fittings for the extensions at the Barking power station. The fittings will be a replica of those supplied to the main station, and will embody the principles of "Efteelite" diffused lighting.

A Swiss Electrical Week

Under the auspices of the Association L'Electrodiffusion and the Office Suisse de l'Eclairagisme, an electrical week has just been held throughout Switzerland with the object of securing an increase in the use of electricity for lighting and domestic purposes. During the week much publicity material was distributed, special displays and demonstrations of apparatus organised, public buildings floodlighted, and films displayed at cinemas.

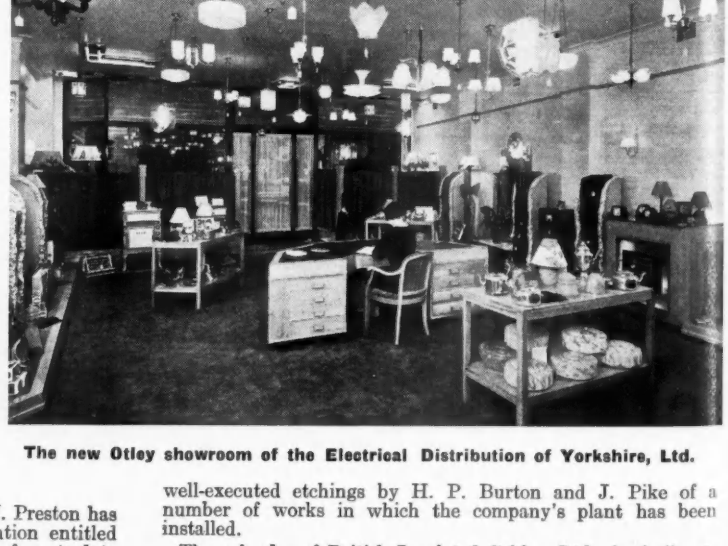
The "I'm Electric" football team of the Middlesbrough Corporation electricity works

Oil Refining Company's Jubilee

Sternol, Ltd., celebrates its fiftieth birthday this year, and in commemoration has issued a souvenir booklet containing a brief history of the company, together with the portraits of the Earl of Verulam (chairman) and chief officials. There are also many pictures showing various sections of the company's works and illustrations of its products.

New Showrooms at Otley

A new Electricity House has been opened in Otley by Electrical Distribution of Yorkshire, Ltd. Members of the Council, together with other prominent Otley residents, were invited to a pre-view and afterwards entertained to luncheon at the Royal White Horse Hotel. During the luncheon Mr. W. B. Woodhouse (managing director of the company) spoke of the development of electricity supply and electrical apparatus. He said they wanted to feel that electricity could be brought into the working-class home and used there just as freely as in larger houses. To get to that stage they had to concentrate on providing electrical apparatus that was reliable and cheap. They had had to help the manufacturer to find how to make them and then get the price down. The showroom, with its modern decoration scheme of pale green and cream, is a perfect background for modern electrical appliances. Not the least attractive feature of the decoration scheme is the employment of the new tinted "flexible" mirror. Serving as it does over 16,000 consumers, the showroom is a welcome addition to Otley's growing shopping centre. The first cooking demonstration attracted such a large crowd of visitors that Miss P. Gillott (E.A.W. Diploma) has arranged to give demonstrations each Monday in addition to those already arranged for each Thursday. We understand that the showroom is one of the new premises which will be taken over by Electricity House, Ltd.



The new Otley showroom of the Electrical Distribution of Yorkshire, Ltd.

Copper for Bus-bars

A comprehensive technical publication by G. W. Preston has been issued by the Copper Development Association entitled "Copper for Bus-bars." It contains 159 pages of up-to-date information on the subject, some of which has not been published before, 28 plates, 29 diagrams, and an adequate index. Included in its scope are the physical, mechanical and electrical properties of the metal (supplemented by nine tables), current-carrying capacity of bus-bars, a.c. effects, electromagnetic stresses, jointing and indoor and outdoor constructions and thermal expansion. Those wishing to go more deeply into the subject will find that the well-selected bibliography is of particular value. The book, which is obtainable from the Copper Development Association free of charge, is a good production both in its matter and in the manner of its presentation.

They're Electric!

The E.D.A. "I'm Electric" device has been used in a multitude of ways, but we believe that the football team of the Middlesbrough Corporation electricity works are the first to adopt it as a badge for their shirts, as shown in the accompanying reproduction from a photograph sent us by Mr. H. Haigh, the borough electrical engineer.

Prosperity in America

The fact that many of the leading United States electrical concerns have had a good year is indicated by the payment of handsome extra dividends to stockholders and bonuses to employés. According to the *Electrical World* the Commonwealth Edison Co. and Public Service Co., of Northern Illinois, will pay an extra dividend of $1 to stockholders and a cash bonus of 2½ per cent. of their annual salaries to employés, who will also receive a 2½ per cent. advance in salaries as from January 1st. The American General Electric Co. is to pay a 50 cents addition to its regular 25 cents dividend, while the employés will receive a payment equal to 6 per cent. of their earnings. Next year an additional 2 per cent. is to be paid on the Employees' Securities Corporation bonds. The operating companies of the Niagara Hudson System have announced a 5 per cent. wage increase for all employés receiving less than $2,600 per annum. Other companies who are increasing dividends and/or paying bonuses are the Allis-Chalmers Manufacturing Co., Cutler-Hammer, Inc., the General Cable Co., the Weston Electrical Instrument Co., and the Black and Decker Manufacturing Co.

Calendars and Diaries

The 1937 pocket diary of the Electrical Power Engineers' Association is bound in green leatherette and contains tables and data which should be of value to members. The information has been selected with a view to meeting requirements in all branches of electrical supply engineering.

The diary of the Brush Electrical Engineering Co., Ltd., is neatly bound in dark red leatherette, and in addition to sectionalised maps of the United Kingdom and road and underground guides for London includes an atlas of the world.

The 1937 calendar of the County of London Electric Supply Co., Ltd., has monthly sheets each of which contains a coloured illustration by H. M. Brock, of "Literary tit-bits electrically cooked."

The calendar of C. A. Parsons & Co., Ltd., contains some well-executed etchings by H. P. Burton and J. Pike of a number of works in which the company's plant has been installed.

The calendar of British Insulated Cables, Ltd., is similar to those of previous years, and in addition to monthly sheets for the current year and for the preceding and following months, calendars for 1936, 1937 and 1938 are included.

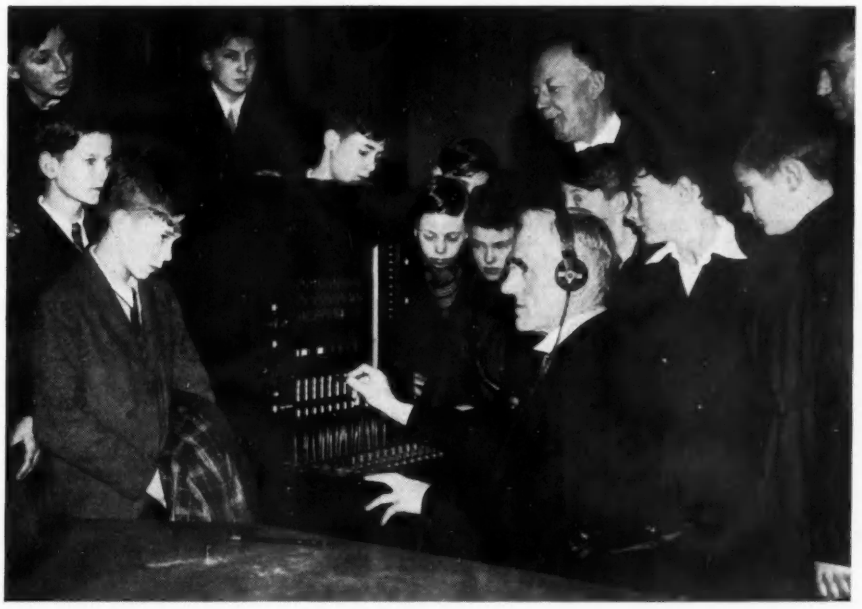
"A Tempting Invitation," by A. D. McCormick, makes

a charming old-world scene for the calendar sent us by Mr. Christopher Wade, of Gabriel, Wade & English, Ltd.

A refill for their desk calendar has been received from Landis & Gyr, Ltd.

A Post Office Exhibition for Children

An illuminated Christmas tree composed of telephone cables fanned out (a photograph appears on page 870) is a seasonable item at the Post Office Exhibition opened last Monday at the Imperial Institute, Kensington, by Lord Iliffe, in the presence of Lord Snell, chairman of the L.C.C., and other distinguished visitors. Although the exhibition, which is open until January 9th, is intended primarily for children, no doubt many grown-ups too will take advantage of the opportunity afforded to learn something of what goes on behind the scenes of the postal organisation. One of the actual trains which operate without drivers, guards, or passengers, on the 6¼-mile Post Office line between Paddington and Whitechapel, carrying 8¾ million mailbags a year; electrically operated indicators showing mail routes and the time saved by air mail; an illuminated decorative frieze, dioramas depicting the loading of mails at Croydon Airport and the London Docks and also a series of uniforms worn by postmen; and a stamp cancelling and counting machine are a few of the exhibits illustrating the various processes in the collection and delivery of letters. Visitors are invited to send a telegram by means of a teleprinter, and watch the various stages of treatment and transmission before receiving it back, in the form of an attractive souvenir. They can also operate an automatic telephone dial and follow all the stages in the telephone exchange right up to the ringing tone at the distant end and the registration of the call. They can find out the time by dialing TIM. A section of a cable manhole shows a network of cable similar to that running under the streets of London. The research side of the P.O.'s work is represented by apparatus from the Dollis Hill Research Station, and includes the cathode-ray oscillograph, one of the uses of which permits the observation of the electrical forms of speech, thus assisting engineers to improve the quality of the transmission of speech. Visitors can speak into a hand microphone and "see" their own voices in the cathode-ray tube. Also, by use of voice delay apparatus similar to that used by the British Broadcasting Corporation for retransmission purposes, it is possible to record voices and hear them later on a loud speaker. In addition to hourly cinematograph performances, there are demonstrations of a machine which produces a discharge of about a quarter of a million volts.



Children being shown by Lord Snell how to use a switchboard at the Post Office Exhibition. Lord Iliffe, who opened the exhibition, is in the background

A New London Cinema

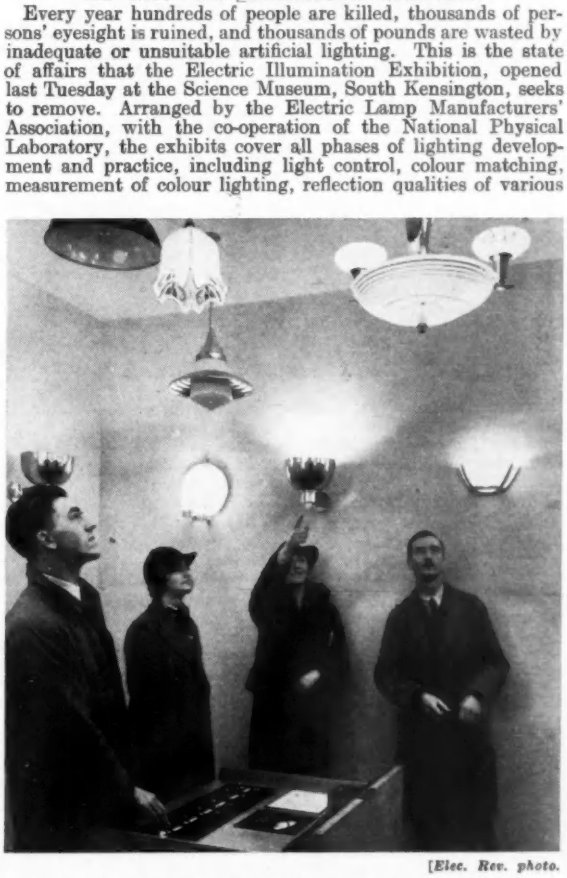
The Cameo News Theatre, Victoria Street, S.W.1, which was opened on Monday last, contains a number of features of electrical interest. The exterior is imposing, for, despite the narrow frontage, 2,500 ft. of neon lighting, supplied by Claude-General Neon Lights, Ltd., forms a pinnacle of light in amber, blue and green. This installation employs sixty-seven G.E.C. transformers. A feature of the entrance is a specially illuminated pay-box consisting of coloured neon lighting placed behind glass bricks manufactured by Lenscrete, Ltd. The canopy lighting is by means of twenty-four floodlights by D. Walter & Co., fitted with 500-watt Mazda lamps, each surrounded by neon tubing. The interior lighting fittings have been designed by Dernier & Hamlyn, while secondary lighting is provided by a D.P. Battery, which is charged by means of a Crypton rectifier. The electrical equipment includes Vincent switchgear, Walsall conduits, and Glover's cables, a William Geipel contactor being used for changing-over the outside lighting for the cheaper rate for night use. The electricity supply is provided by the Westminster Electric Supply Corporation; the consulting engineers were A. E. Mohring & Son, and the electrical contractors were Thorpe & Thorpe, Ltd. A picture of the exterior of the cinema appears on page 853.

Social Events

The Staff Dramatic Society of the Lancashire Electric Power Co. gave excellent performances of "9.45," a mystery play in three acts, at the Queen's Hall, Manchester, on December 9th, 10th and 11th. This was the most ambitious piece of work so far undertaken by the Society, but the players came through with flying colours in spite of the fact that a severe fog on the opening night depleted the audience. Mr. J. Furrett, assistant engineer and manager, congratulating the Society after its final performance, said that he was glad to feel that there was the same spirit of co-operation socially amongst the staff as was displayed by them in their daily work. He welcomed amongst the guests Mr. A. J. Hutchinson, engineer and manager of the Farnworth Electricity Department, who suitably replied. Mr. I. L. Thomas, producer, responded, thanking on behalf of the Society Mr. Purrett for his appreciation. He said that sincere thanks were due to those who had worked behind the scenes on the three nights. A scene from the play is reproduced on page 857.

An Electrical Illumination Exhibition

Every year hundreds of people are killed, thousands of persons' eyesight is ruined, and thousands of pounds are wasted by inadequate or unsuitable artificial lighting. This is the state of affairs that the Electric Illumination Exhibition, opened last Tuesday at the Science Museum, South Kensington, seeks to remove. Arranged by the Electric Lamp Manufacturers' Association, with the co-operation of the National Physical Laboratory, the exhibits cover all phases of lighting development and practice, including light control, colour matching, measurement of colour lighting, reflection qualities of various surfaces, glare and the effect of contrast, correct and incorrect methods of street, factory, and shop lighting, and the effect



[Elec. Rev. photo.

The lighting fittings demonstration room at the Science Museum, South Kensington

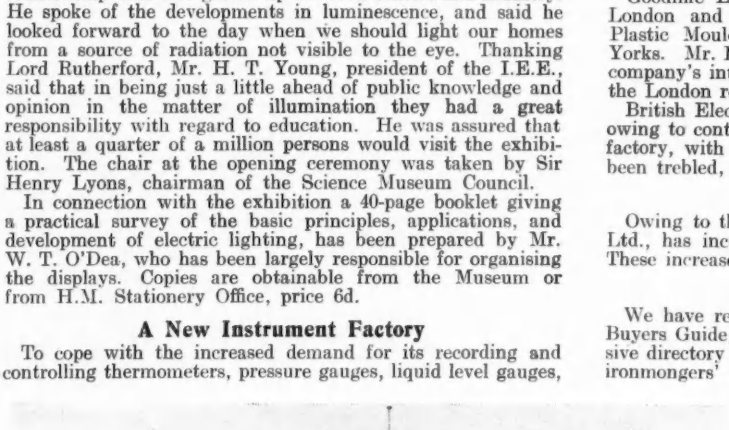
of dirt. Two rooms specially equipped with control boards permit visitors to see for themselves the merits of different domestic and architectural lighting systems, and, in addition, there is the well-known light-sight tester. A model aerodrome illustrates the requirements of lighting for night flying, while close by a representative collection of floodlighting equipment are two models, one of St. Paul's Cathedral and the other of Bush House, arranged so that various methods of treatment can be compared. Examples of street lighting and industrial fittings are featured, and in conjunction with the electric discharge lighting exhibits is a series of demonstrations illustrating how part of the invisible ultra-violet radiation of a discharge lamp can be converted into visible light by using coatings of luminescent powders; the increase in efficiency is in some cases remarkable. By way of contrast to these modern developments a small historical exhibit illustrates the progress of illumination technique through the ages.

Performing the opening ceremony, Lord Rutherford, chairman of the Advisory Council of the Department of Scientific and Industrial Research, gave a brief *résumé* of the history of illumination, and declared that developments during the past few years had been an admirable example of the close relationship that had grown up between science and industry. He spoke of the developments in luminescence, and said he looked forward to the day when we should light our homes from a source of radiation not visible to the eye. Thanking Lord Rutherford, Mr. H. T. Young, president of the I.E.E., said that in being just a little ahead of public knowledge and opinion in the matter of illumination they had a great responsibility with regard to education. He was assured that at least a quarter of a million persons would visit the exhibition. The chair at the opening ceremony was taken by Sir Henry Lyons, chairman of the Science Museum Council.

In connection with the exhibition a 40-page booklet giving a practical survey of the basic principles, applications, and development of electric lighting, has been prepared by Mr. W. T. O'Dea, who has been largely responsible for organising the displays. Copies are obtainable from the Museum or from H.M. Stationery Office, price 6d.

A New Instrument Factory

To cope with the increased demand for its recording and controlling thermometers, pressure gauges, liquid level gauges, humidity instruments, time cycle controllers, and other allied instruments and to improve service facilities, Bristol's Instrument Co., Ltd., has just transferred its production to an up-to-date new factory at Brent Crescent, North Circular Road, West Twyford. The move, which has been carried out under the direction of Mr. G. H. Gaites, managing director, forms part of a programme of expansion which is being followed by the associated companies, the Bristol Company of Canada, Ltd., Toronto, and the Bristol Co., Waterbury, Connecticut, U.S.A., and which has been encouraged through the increased adoption of control instruments by industrial plants, not only as a means of standardising the quality of products but also for the purposes of reducing operating costs. The whole of the manufacturing processes are carried out at the new factory. During a visit last week we saw in course of construction special recording and regulating instruments for use in bakeries, dairies, and breweries. The factory at present gives employment to about fifty men, and with a view to further extensions space has been secured at the rear of the building which will enable accommodation to be nearly trebled. While entirely separate, the company is able to call upon the U.S.A. and Canadian organisations for technical assistance.



Exterior and interior views of the new West Twyford factory of Bristol's Instrument Co., Ltd.

Trade Announcements

The telephone number of the Manchester works of Erskine, Heap & Co., Ltd., has been changed to Deansgate 4561-2-3.

G. W. B. Electric Furnaces, Ltd., has removed its registered offices, including the Sales Department, Drawing Office and Accounts Department, to Belgrave House, Belgrave Street, W.C. (telephone: Terminus 5791-2. Telegraphic address: Gibwildbar, Kingscross, London). The company's works will remain at Holloway, Dudley and Birmingham, and the associated company, Wild-Barfield Electric Furnaces, Ltd., will remain at Holloway, N.

The Ipswich Branch of the General Electrical Co., Ltd., has transferred its stockrooms, dispatch and receiving departments from Electric House, Lloyds Avenue, to premises in Brooks Hall Road, Ipswich. The offices, counter and radio service remain at Electric House, to which all correspondence should continue to be addressed. In order still further to improve service to customers an extended van service has been organised.

Astralite Electrical Products, Ltd., has opened another warehouse at 118 and 119, Great Saffron Hill, E.C.1. Inquiries, however, should be sent to 60-61, Red Lion Street, E.C.1.

Goodliffe Electric Supplies, Ltd., has been appointed the London and Southern Counties representative for Forbes Plastic Mouldings, Ltd., Bridge Works, Stamford Bridge, Yorks. Mr. P. Watts, who has hitherto looked after the latter company's interests, will continue to do so in the capacity of the London representative of Goodliffe Electric Supplies, Ltd.

British Electric Domestic Appliances, Ltd., informs us that owing to contracts already in hand it has taken over another factory, with the result that its capacity for production has been trebled, and it is already in full production for 1937.

Price Increases

Owing to the rising cost of raw materials, Aidas Electric, Ltd., has increased the prices of its electric water heaters. These increases came into force on December 2nd.

An Ironmongers' Guide

We have received the "Ironmongers Diary and Hardware Buyers Guide, 1937." In addition to providing a comprehensive directory of manufacturers, trade marks and brands, and ironmongers' wares, this publication has a literary section which includes information for domestic engineers, sections dealing with licences in trade, poisons and postal regulations, railway rates, tables of gauges and weights of metals, and a register of proprietary names.

Workers' Representative on West Midlands J.E.A.

The Minister of Labour has given notice that after January 12th, 1937, he will designate to the West Midlands Joint Electricity Authority, in accordance with section 2 (9) of part I of the first annex to the schedule to the West Midlands Electricity District Order, 1925, the employés organisations having members in the employment of authorised undertakings in the District, in order that such organisations may choose a representative to be a member of the Joint Authority. Any employés' organisations desiring to be so designated should make application in writing to the Minister not later than January 9th, on a form obtainable from the Secretary to the Ministry of Labour.

Christmas Holidays

Parmiter Hope & Sugden, Ltd., will close their works and offices for the Christmas holidays from December 24th to December 28th, and for the New Year from December 31st to January 4th.

The works of Bruce Peebles & Co., Ltd., will close on December 31st, and will re-open on Wednesday, January 6th. The head office in Edinburgh will be closed on Christmas Day.

The Jackson Electric Stove Co., Ltd., is closing its offices at 143, Sloane Street, London, S.W.1, from Christmas Eve till Tuesday morning.

For Sale

Wallasey Corporation invites offers for the purchase of boiler plant.

(See our classified advertisements.)

Radio Apparatus in Rumania

It is reported that an agreement has been entered into between the Rumanian Electro-Industry concern and the Siemens and Halske Co., with regard to the apparatus of the Telefunken Co. Under the arrangement it is intended to erect in Brasov a works for the production of radio apparatus and component parts. Orders are said to have already been received from the Rumanian Air Ministry.

British Overseas Electrical Trade

In November the value of British electrical equipment shipped abroad was £1,324,218 as compared with £1,411,869 in the corresponding month last year and £1,429,968 in October, both of which contained one working day more than last month. Imports were £426,795, against £408,578 in the corresponding month of last year and £451,822 in October.

Lamp Sales in Germany

It is stated that between the financial years 1932-33 and 1935-36 the sale of filament lamps—which are subject to the State tax in Germany—has risen from 54,500 to 83,100 millions. The increase in neon tubes has also advanced in numbers in the same period from 24,000 to 36,000.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances :—

CHEMICALS, ETC.	Price. December 16th.	Fortnight's Inc. or Dec.
[a] Acid, Oxalic ... ... per cwt.	50s.	—
[a] Ammoniac, Sal ... ... per ton	£36	—
[a] Ammonia, Muriate (large crystal) ... ,,	£18 10s.	—
[a] Borax ... ... ,,	£17	—
[a] Copper, Sulphate ... ... ,,	£15 10s.	—
[a] Potash, Chlorate ... ... per lb.	3¾d. to 4¼d.	—
[a] ,, Perchlorate ... ... ,,	6d.	—
[a] Shellac ... ... per cwt.	£4 18s.	—
[a] Sulphur Commercial ... ... per ton	£11	—
[a] ,, Roll ... ... ,,	£11	—
[a] Soda Chlorate ... ... per lb.	3¼d. to 3¾d.	—
[a] ,, Crystals ... ... per ton	£5 to £5 5s.	—
[a] Sodium Bichromate, casks ... ... per lb.	4d. nett.	—
METALS, ETC.		
[b] Aluminium, Ingots ... ... per ton	£100 to £105	—
[b] ,, Wire ... ... per lb.	1/1 to 1/9	—
[b] ,, Sheet and Foil ... ... ,,	1/3 to 2/9	—
[p] Babbitts Metal and Anti-friction Metals—		
Grade I ... ... per ton net	£214	—
Grade II... ... ... ,,	£147	—
Grade III ... ... ,,	£76	—
[c] Brass (rolled metal 2" to 12" basis) per lb.	8½d.	½d. inc.
[c] ,, Tubes (solid drawn) ... ... ,,	10½d. to 10¾d.	—
[c] ,, Wire, basis ... ... ,,	8⅝d.	½d. inc.
[c] Copper Tubes (solid-drawn)... ... ,,	11½d.	—
[g] ,, Bars (best selected)... ... per ton	£77	—
[g] ,, Sheet... ... ... ,,		
[g] ,, Rod ... ... ,,		
[d] ,, (Electrolytic) Bars ... ... ,,	£49 15s.	10s. inc.
[d] ,, ,, Wire Rods ... ,,	£55 15s.	10s. inc.
[d] ,, ,, H.C. Wire ... per lb.	8 1/16d.	—
[f] Ebonite Rod ... ... ,,	1/6 to 2/- plus	—
[f] ,, Sheet ... ... ,,	1/3 to 1/6 10%	—
[a] German Silver Wire, Nos. 1 to 12 .. ,,	2·2	—
[h] Gutta-percha, fine ... ... ,,	nom.	—
[h] India-rubber, Para-fine ... ... ,,	1/0½	½d. inc.
[i] Iron, Pig (Cleveland, No. 3) ... per ton	67/6	—
[i] ,, Wire galv. No. 1, P.O. Qual.... ,,	£20	—
[g] Lead, English Pig ... ... ,,	£28	£3 5s. inc.
[g] Mercury ... ... per bot.	£14 5s.	—
[c] Mica (in original cases) small ... per lb.	9d. to 1/6	—
[e] ,, ,, ,, medium ... ,,	5/- to 10/-	—
[e] ,, ,, ,, large ... ,,	10/6 to 17/6 up	—
[p] Phosphor Bronze, plain castings ... ,,	1/1	—
[p] ,, ,, drawn bars & rods ,,	1/0½d.	—
[p] ,, ,, rolled strip & sheet ,,	1/-	—
[p] ,, ,, wire ... ... ,,	1/1¼d.	—
[o] Platinum ... ... per oz.	£9 15s.	—
[d] Silicium Bronze Wire ... ... per lb.	9 1/16d.	—
[g] Spelter... ... ... per ton	£18 11s 3d.	£1 17 6 inc.
[r] Steel, Magnet, in bars ... ... per lb.	7¼d.	—
[g] Tin, Block (English) ... ... per ton	£230 10s.	—
[n] ,, Wire, Nos. 1 to 16 ... ... per lb.	3/11	—

Quotations supplied by :—

[a] G. Boor & Co.
[b] The British Aluminium Co., Ltd.
[c] Thos. Bolton & Sons, Ltd.
[d] Frederick Smith & Co.
[e] F. Wiggins & Sons.
[f] India Rubber, Gutta Percha and Telegraph Works Co., Ltd.
[g] Henry Gardner & Co., Ltd.
[h] Edward Till & Co.
[i] Bolling & Lowe.
[n] P. Ormiston & Sons.
[o] Johnson Matthey & Co.
[p] C. Clifford & Sons, Ltd.
[r] W. F. Dennis & Co.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead, rubber, tin and spelter, up to the time of going to press, are given in our "Business Notes" under the same heading.

New Catalogues and Lists

British Electric Domestic Appliances, Ltd., Bedal Works, Kingsway, Waddon, Surrey.—The "Bedal" Christmas bulletin.

Girlings, Ltd., Maldon.—A catalogue of electric fires and cooking appliances.

Winsor Engineering Co., Ltd., 9, Victoria Street, London, S.W.1.—A catalogue of ventilating equipment "Draughtless Ventilation."

W. Crockatt & Sons, Ltd., 62/64, Darnsley Street, Glasgow, S.1.—A descriptive booklet dealing with electric salinometers and densometers.

British Insulated Cables, Ltd., Prescot.—A booklet on condensers for radio, television, telephony and neon signs and details of "Macintosh" mining type cable sealing and coupling system.

Siemens Electric Lamps & Supplies, Ltd., 38/39, Upper Thames Street, London, E.C.4.—A new catalogue of primary cells and batteries.

James Beresford & Son, Ltd., Cato Street Works, Birmingham, 7.—Details of the multi-stage centrifugal pumps.

British Thomson-Houston Co., Ltd., Crown House, Aldwych, London, W.C.2.—A catalogue of fittings for the Coronation.

Brilliant Neon, Ltd., 131, Uxbridge Road, Shepherd's Bush, London, W.12.—A leaflet showing Coronation signs.

Silvagrey Electric, Ltd., High Street, Dorking.—Details of Coronation fittings.

Ionlite, Ltd., 89, Scrub Lane, London, W.10.—A well-produced photogravure booklet has been issued showing all kinds of neon sign installations; there is also a section in colour on heraldry.

Crossley Bros., Ltd., Openshaw, Manchester, 11.—The *Crossley Chronicles* for November, containing details of a Diesel-electric cinema installation.

Corfield-Sigg, Ltd., Trafalgar Works, Merton Abbey, S.W.19.—A leaflet illustrating "Corfalgar" aluminium ware for cooking.

Bankruptcy Proceedings

C. H. Chinery (lately trading with William Goldstone Harden, in partnership as Harden & Chinery), electrical and mechanical engineers, 7, Barnsbury Street, Islington.—This firm failed in July, 1931, and on December 10th the debtor Chinery applied to Mr. Registrar Kean at the London Bankruptcy Court for an order of discharge. Mr. V. Armstrong, Assistant Official Receiver, reported that the firm's liabilities amounted to £3,953, against assets 5s., and the applicant returned separate debts £500 and no separate assets. The discharge was suspended for twelve months from November 19th, when the applicant was originally before the Court.

C. E. Wheat, Haughton, near Stafford, lately carrying on business at 2, Lichfield Road, Stafford, as Radio Stores, wireless dealer.—This debtor attended at the Shire Hall, Stafford, recently, for his public examination. He attributed his failure to keen competition, heavy trading expenses and depression in trade. His statement of affairs showed ranking liabilities of £646 and assets of £63, leaving a deficiency of £584. The examination was closed.

R. T. Collins, 41, Market Street, Penryn, Cornwall, wireless dealer.—The public examination in this matter was held at the Town Hall, Truro, on December 7th, and was closed. Debtor, who attributed his failure to losses on cars, heavy repairs, hire-purchase payments, bad debts and defaults on cycles and wireless sets on hire-purchase, had filed a statement of affairs showing a deficiency of £263.

T. S. Cocks, wireless dealer, 219, Milton Road, Portsmouth.—Last day for receiving proofs for dividend December 23rd. Trustee, Mr. A. L. Medcalf, 87, High Street, Portsmouth, Official Receiver.

L. Hardaker, radio and electrical engineer, 32, Broadgate Walk, Horsforth, Leeds.—First and final dividend of 2s. 6d. in the £, payable December 18th at 24, Bond Street, Leeds.

J. L. Sylvester, radio and wireless engineer, 53, Ellers Road, Harehills, Leeds.—Receiving order made December 5th on debtor's own petition.

C. H. Large (Torquay and South Devon Electrical Co.), electrician, 1, Old Mill Road, Chelston, Torquay.—First meeting December 18th at Exeter Bank Chambers, Broadgate, Exeter. Public examination January 21st at the County Court Offices, Old Town Hall, Torquay.

W. H. Tordoff, electrical engineer, 10, Burnett Avenue, Manchester Road, Bradford.—Trustee, Mr. W. F. Cresswell, 71, Manningham Lane, Bradford, Official Receiver, released December 3rd.

J. L. H. Graham (deceased) (West Yorkshire Crystal Lamp Co.), electric lamp merchant, lately of 109, Thornton Road, Bradford.—Last day for receiving proofs for dividend, December 29th. Trustee, Mr. W. F. Cresswell, 71, Manningham Lane, Bradford, Official Receiver.

Company Liquidations

Radio Rentals, Ltd.—Winding up voluntarily for reconstruction purposes. Liquidator, Mr. A. W. Bentley, 7-8, Poultry, E.C.

The registration of a new company with the same title is recorded on page 874.

Variable Power Transmissions, Ltd.—Particulars of claims by January 5th to the liquidator, Mr. H. J. Veitch, 9, Coleman Street, E.C.2.

Private Arrangements

E. A. Porter, radio dealer, 152, Harrison Road, Leicester.—The creditors herein met recently at Leicester, when the statement of affairs showed liabilities of £197. Of that amount £162 was due to unsecured creditors, and there were contingent liabilities of £56, of which it was anticipated that £36 would rank. The net assets were £12, leaving a deficiency of £185. Debtor attributed his position to trading losses owing to his inability to attend to the business. The drawings had been negligible. It was decided that the assets should be realised by the debtor to the best possible advantage and that a further meeting of the creditors should be held at the end of January next.

Electricity Supply

Lighting, Domestic, Power

Barrow-in-Furness.—EXTENSIONS AND IMPROVEMENTS.—In respect of the extension at Natal Road sub-station and the installation of fire-protection apparatus at the Buccleuch Street works, the Electricity Committee has received sanction to a loan of £5,730. Consent has been obtained to certain works being carried out at the Coniston power house at a cost of £1,500, while it is proposed to borrow £9,955 for mains, £13,903 for plant and £1,200 for buildings in connection with extensions to the high-voltage system, £6,000 for meters and £4,000 for sub-station plant.

Blackburn.—CORRECTION.—In our last issue (page 832) we stated that the " unit " charge under the rateable value tariff was being reduced from 1d. to ¾d. for the first 250 kWh per quarter. This note related to the Colne undertaking—not to Blackburn. Mr. R. H. Harral, the Blackburn engineer, reminds us that the " unit " charge under his tariff is only ½d.

Blackpool.—CHANGE-OVER.—In connection with the change-over, mains extensions are to be carried out from Yorkshire Street to Adelaide Place and from Keswick Road to the St. John's estate.

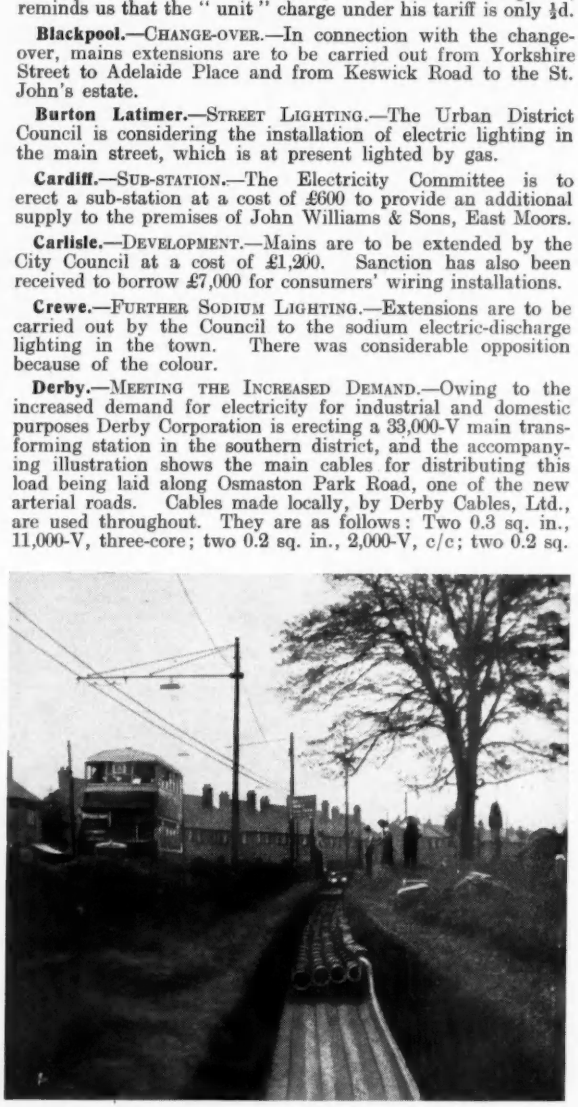
Burton Latimer.—STREET LIGHTING.—The Urban District Council is considering the installation of electric lighting in the main street, which is at present lighted by gas.

Cardiff.—SUB-STATION.—The Electricity Committee is to erect a sub-station at a cost of £600 to provide an additional supply to the premises of John Williams & Sons, East Moors.

Carlisle.—DEVELOPMENT.—Mains are to be extended by the City Council at a cost of £1,200. Sanction has also been received to borrow £7,000 for consumers' wiring installations.

Crewe.—FURTHER SODIUM LIGHTING.—Extensions are to be carried out by the Council to the sodium electric-discharge lighting in the town. There was considerable opposition because of the colour.

Derby.—MEETING THE INCREASED DEMAND.—Owing to the increased demand for electricity for industrial and domestic purposes Derby Corporation is erecting a 33,000-V main transforming station in the southern district, and the accompanying illustration shows the main cables for distributing this load being laid along Osmaston Park Road, one of the new arterial roads. Cables made locally, by Derby Cables, Ltd., are used throughout. They are as follows: Two 0.3 sq. in., 11,000-V, three-core; two 0.2 sq. in., 2,000-V, c/c; two 0.2 sq. in., 200-V, twin-core; and one 0.3 sq. in., 600-V, four-core. The 11,000-V cables are for linking up the new transformer station to the various industrial consumers in the district. The 2,000-V and 200-V feeders are for supplying the domestic consumers and are made necessary by the large demand for electric cookers and water heaters. The 0.3 sq. in., four-core cable is for feeding a new trolley-bus route. Six cables are laid on the bottom of the trench and are protected by concrete slabs. Above are four conduits laid for drawing in extra cables for future development. On the top is laid the 0.2 sq. in. twin cable, which is readily accessible for jointing services without disturbing the main cables.



Cable-laying in progress at Derby

Dewsbury.—METERS AND CABLES.—The Corporation has applied for sanction to a loan of £6,000 for meters. Cables are to be laid to give a supply to houses in the Park area.

Doncaster.—ILLUMINATIONS.—Some 6,000 coloured electric lamps were recently switched on for the Christmas illuminations in the chief shopping streets. Half a mile of the Great North Road through the centre of the town, adjoining streets and the exterior of the Market Hall are included in the scheme. Across the front of the Mansion House is an illuminated Christmas greeting sign.

Eastbourne.—SUPPLY TO GORRINGE VALLEY.—Sanction to a loan of £4,000 is being sought by the Electricity Committee to cover the cost of affording a supply of electricity to the Gorringe Valley estate.

East Ham.—ELECTRICAL EQUIPMENT.—Sanction has been obtained by the Electricity Committee to loans of £5,243 for a sub-station at Grangewood telephone exchange and completion of the north ring main, and £10,401 for extensions of mains.

STREET LIGHTING.—The Works Committee is to improve street lighting at a cost of £9,512.

Exeter.—LOANS FOR EQUIPMENT.—Permission is being sought by the Electricity Committee to borrow £30,000 for mains and services. It is also negotiating a loan of £2,592 for reconstructing the 6,600-V circuit-breakers at the power station.

Glasgow.—FREQUENCY STANDARDISATION.—Sanction has been received by the Electricity Committee to a loan of £58,500 in connection with the standardisation of frequency.

Gt. Yarmouth.—LOANS.—The Electricity Committee is seeking sanction to borrow £20,000 for mains and services and £15,000 for domestic appliances.

Hastings.—PRECAUTION AGAINST POWER STATION FIRES.—The borough electrical engineer has reported that he has had under consideration the conditions which have caused explosions of oil switches in other power stations, and that he is of opinion that it is essential to make alterations at Broomgrove. He proposes to install a drain under each of the 11,000-V switch units to convey the oil to an underground tank partially filled with granite chippings outside the building.

Higham Ferrers.—OVERHEAD LINES.—The Rushden and District Electric Supply Co., Ltd., proposes to erect additional overhead lines in Simpson Avenue and George Street, Higham Ferrers.

India.—COCHIN ELECTRICITY SUPPLY.—It is reported in *Indian Engineering* that a large power house has recently been put into commission at Ernakulam, capital of Cochin State. The first electricity supply scheme in Cochin was prepared some twenty years ago. Subsequent negotiations with the Madras Government for the extension of its Pykara scheme failed.

Inverness.—LOWER CHARGES.—Reductions have been made in the charges for electricity, states Mr. J. C. McLean, the electrical engineer and manager. The lighting charge is lowered from 5¼d. to 5d. inside the burgh boundary, and from 5¾d. to 5½d. per kWh outside. The running charge under the contract tariff is reduced from 1¼d. to 1d. per kWh in the burgh and from 1½d. to 1¼d. outside. The hire charge for cookers is also reduced.

Irish Free State.—DUBLIN.—A scheme has been prepared by the city engineer for the replacement of the arc-lamps at present used for street lighting by filament lamps.

Liverpool.—CLARENCE DOCK EXTENSIONS.—Work on the extensions to the Clarence Dock power station, estimated to cost £1,250,000, is well advanced. The first turbo-alternator set and three boilers are to be completed by October next, and the second turbo-alternator set and two boilers are to be ready for operation in October, 1938. When the work is finished the station will have cost £3,500,000, and its capacity will be doubled. Mr. P. J. Robinson, city electrical engineer, stated last week that the debt on Lister Drive No. 1 station was entirely written off, Lister Drive No. 2 had £90,000 outstanding, which would be cleared by 1939, and the debt on Lister Drive No. 3 was £700,000, which would be cleared by 1945.

Loughborough.—MODIFIED HIRE CHARGE.—A decision has been reached by the Electricity Committee to reduce the charge for the hire of electric cookers by 6d. per quarter in the New Year.

Nelson.—LOANS.—Application has been made for sanction to borrow £20,000 for electrical appliances for sale on hire-purchase, and £3,350 for cables, transformers and general equipment necessary.

North Lincolnshire.—RURAL EXTENSIONS.—Pursuing its active policy of rural development the North Lincolnshire and Howdenshire Electricity Co., Ltd., has recently completed a number of extensions in the Gainsborough area. Supplies are now available at Brampton, Corringham, Gate Burton, Heapham, Hemswell, Kniath, Lea, Marton, Morton, Springthorpe and Torkney. Constructional work is in progress at Blyton and Laughton. A supply to Scotter and Scotton, as well as Exeby, is also under consideration.

North Wales.—TRANSFER OF UNDERTAKING.—Representatives of the Councils of Oswestry and Wrexham, Pwllheli, Prestatyn, Criccieth, Wrexham and Hawarden, attended before the Electricity Commissioners a few days ago in regard to a proposed transfer to the North Wales Power Co. of a number of the undertakings of the Electricity Distribution of North Wales, Ltd. They urged the Electricity Commissioners to defer the question of giving their consent to such a transfer for a year or two in order to see whether Parliament passes legislation for the purpose of giving effect to the recommendations contained in the McGowan Report.

Scarborough.—CHEAPER BULK SUPPLY.—The Central Electricity Board has amended the agreement to be entered into between the Council and the Board in connection with the operation of the Council's generating station so that the charge per kW as from January 1st, 1937, shall be £4 instead of £4 2s. 6d.

METERS.—Application is being made by the Town Council to borrow £20,000 for meters.

South Midland Counties.—AN AMENDED TARIFF FOR SMALL HOUSES.—The Bedfordshire, Cambridgeshire and Hunts Electricity Co. has adopted a fixed charge of 42s. per annum net for houses of a rateable value of £10 or under in urban areas, £7 or under in the rural areas, or for any Council house. The "unit" charges remain at 1d. during the winter quarters and ¾d. during the summer quarters.

South Shields.—MODIFIED CHARGES.—A revised scale of electricity charges for domestic consumers has been adopted by the Electricity Committee, and is to be placed before the Town Council for confirmation. The object is to encourage the use of electricity for heating and cooking purposes.

Torquay.—TRANSMISSION.—A scheme of the electrical engineer for the erection of high-voltage lines and the neceessary ancillary works to afford a supply of electricity to the village of Harberton and Dundridge Park, at an estimated cost of £1,000, has been approved by the Electricity Committee.

LOAN SANCTION.—The Committee is seeking sanction to borrow £4,000 for instruments and meters.

TRANSFER OF PAIGNTON UNDERTAKING.—A sub-committee is to meet representatives of the Paignton Urban District Council to discuss the question of obtaining expert advice on the advisability of the transfer of the electricity undertaking at Paignton from the present owners to the Torquay Corporation.

Tynemouth.—FEE FOR CHANGING A HIRED COOKER.—Since the standardisation of a new type electric cooker on hire by the Electricity Department a number of consumers have applied to have their existing cookers replaced, and in order to avoid the accumulation of a large number of second-hand cookers a fee of £1 is to be charged in all future cases where a change of cooker is desired.

Wallsend-on-Tyne.—ANOTHER CONFERENCE?—The following resolution proposed by the Chepping Wycombe Town Council has been passed by the Wallsend Town Council: "That this Council, having considered the Report of the Parliamentary Committee on Electricity Distribution of May, 1936, is of opinion that some of the recommendations have not sufficient regard to the equitable rights of consumers in general, and particularly of consumers in the small areas where local authorities have rights to purchase about to mature, and calls upon a conference of local authorities to discuss the matter."

Cleethorpes Town Hall floodlighted by Revo C.9423 fittings and 150-W sodium lamps

Walsall.—SUB-STATION.—The Electricity Committee is seeking sanction to borrow £9,000 for sub-station equipment.

Weymouth.—CHRISTMAS ILLUMINATIONS.—The electrical engineer is negotiating with the local traders regarding the use of strip lighting at Christmas on the same terms as last year, the apparatus being lent without charge, apart from a nominal connection fee.

Traction

France.—NEW TRAFFIC SIGNALS.—Automatic traffic signals which are lighted only when a vehicle approaches the crossing have been introduced at Nancy. To secure this a photo-electric cell is installed in a small pylon in the centre of the street at a point near the crossing. This is sufficiently low for any vehicle coming along the roadway to interrupt the beam of light which is trained on to it from a similar pylon on the kerb, so operating a relay system to switch on a green light in the direction of the oncoming vehicle while a red one is lighted in the direction of the cross street.

[*Elec. Rev.* photo

A Christmas display in one of the windows of the County of London Electric Supply Co.'s showrooms at Streatham

Ipswich.—TROLLEY-BUSES.—A re-organisation of the trolley-bus routes has taken place. Two services have been diverted and new circular routes inaugurated.

Italy.—ELECTRIC RAILWAY SIGNALLING STARDARDISATION.—In a recent issue of the *Revista Techica delle Ferrovie Italiane* Signor C. Bellomi mentions that, following exhaustive tests extending over a period of ten years, the Italian State Railway authorities have recently commenced the standardisation of electric railway signals and their control mechanism. The author gives an outline of the principles adopted as the basis for the standardisation and a description of some of the standardised circuits and apparatus.

ROME TRANSPORT SCHEME.—A project for improving transport facilities in Rome in time for the 1941 International Exhibition to be held there is under consideration. It includes an underground connection of the electric tramways with the Roman castles, and of the Ostia Lido electric railway with the Rome Central railway station. The latter scheme provides for the construction of an underground extension from the San Paolo station of the Lido railway to the Termini railway station through Piazza Venezia and Via Nazionale, and another underground extension from Via Appia to the Termini railway station. The first extension would be 5,300 km. long, and the second 4,600 km. long. An increase in the carrying capacity of the Ostia Lido electric railway by laying further tracks is also contemplated. The cost of these improvements is estimated at about 345 million lire.

London.—ELECTRIC REFUSE VEHICLES FOR WESTMINSTER.—Plans for the purchase of electrically driven mechanical horses to replace the present petrol vehicles for refuse collection were introduced at yesterday's meeting of the Westminster Highways Committee. The cost of eighteen vehicles would be £9,000.

Northern Ireland.—BELFAST.—An experimental trolley-bus service will probably be started on one route in Belfast in the near future. A deputation from the Tramways Committee, which returned recently from a tour of inspection of the English cities where trolley-buses are in operation, presented a report to the Committee favouring the introduction of this system of transport. The deputation conferred with representatives of municipal transport undertakings in Birmingham, Bournemouth, Nottingham, Portsmouth, Wolverhampton, and with officials of the London Passenger Transport Board. They

also inspected works where trolley-buses are constructed. The deputation is of the opinion that, provided the requisite number of trolley-buses can be secured under the terms of the scheme, tramcars should not be operated on Falls Road during the trial of the trolley-buses. The price of electric power, states its report, is one of the governing factors in the successful operation of trolley-buses, but it would appear that tramcar fares can be approached more readily with trolley-buses than with i.c.-engined buses. Experience shows that the life of trolley-buses is considerably in excess of the life of petrol and Diesel-engined buses. The deputation found that in almost every case the inauguration of trolley-buses was followed by an increase in passenger traffic on the converted routes, such increase varying from 10 per cent. to 30 per cent.

Poland.—ELECTRIC RAILWAY AT WARSAW.—M. Kwiatkowski, Minister of Finance, and Colonel Ulrich, Minister of Communications, formally opened to-day the first section of the Warsaw and district electric railway system, which is being constructed for the Polish State Railways by a contractors' committee, on which the English Electric Co., Ltd., and the Metropolitan-Vickers Electrical Export Co., Ltd., are represented. According to a report from *The Times'* Warsaw correspondent, the section opened runs from Warsaw to Otwock and Pruszkow, a distance of about 40 miles. The two remaining sections, covering nearly 100 miles, will be put into operation during next year. The contract, which has been undertaken with the help of the Export Credit Guarantee Fund, amounts in all to about £2,500,000, most of which is being spent in Great Britain for electrical installations.

Switzerland.—RAILWAY ELECTRIFICATION.—Work is well in hand on the electrification of the Sonceboz-Moutier section of the Swiss Federal railways, over which electric trains are expected to be running early next year. The new line will complete the second programme of Swiss railway electrification commenced in 1930, and, according to the Swiss Press, no further programme is contemplated.

ZURICH MUNICIPAL ELECTRIC TRAMWAY SYSTEM.—With the title of "Städtische Strassenbahn Zürich, 1896-1936," a booklet has just been issued by the Municipal Council of Zürich giving a historical account of the development of the public transport services in that city during the past forty years. The booklet has been prepared by Herr A. Winterhalter, manager of the undertaking, and Dr. A. Senti, and shows that in July, 1936, the municipality acquired a privately owned electric tramway undertaking with services operating over about 10½ miles and carrying between 7 and 8 million passengers per year. During the forty years which have since elapsed the tramway system in the city, apart from a number of motor-bus services, has been extended to nearly 64 miles, while the number of passengers annually carried is now in the neighbourhood of 90 millions.

Communications

Great Britain.—OVERSEAS GREETINGS BY TELEGRAPH.—Cable & Wireless, Ltd., announces that special reduced rates for telegrams containing Christmas and New Year greetings are available from December 14th to January 6th. Telegrams of ten words can be sent to Australia and New Zealand for 4s., and Eastern Canada, New York, India and South Africa for 2s. 6d. In addition, the customary fixed text messages will be available to the United States and certain other destinations at a cost of 4s. per telegram.

[*Elec. Rev. photo*

A Christmas tree made of telephone cables at the Post Office Exhibition for Children (see page 865)

The Postmaster-General announces that for the period beginning next Wednesday and ending on Monday, January 4th, but excluding Christmas Day, a reduction will be made in overseas telephone charges. Generally speaking, the rates will be those normally applying on Saturdays.

NEW WESTERN RADIO STATION.—The B.B.C. has chosen a site at Start Point, near Plymouth, for the new 100 kW Western broadcasting station.

Railway Electrification in Europe

WITHIN the last four years the electrified route mileage of European railways has increased by over 2,100, equivalent to 25 per cent. Of the total of approximately 256,000 route miles the electrified mileage is only 4¼ per cent., but in practically every case the traffic handled is heavier than it would be if *pro rata* to the mileage. For example, 35 per cent. of the system of the Swedish State Railways is operated electrically, but it carries over 45 per cent. of the total traffic. Similarly, on the Swiss Federal Railways, the 75 per cent. of the route mileage electrified carries 90 per cent. of the traffic. In these figures, and in the table below, account is taken only of steam railways which have been electrified, and not underground lines or other systems operated electrically since their beginning.

Due largely to the rapid extension of the 3,000-V d.c. system in southern and eastern Italy, d.c. traction has shown as great a proportional increase as a.c., and this result has been helped by the conversion of certain three-phase lines (Prato-Pistoia and Rome-Avezzano) to high-voltage d.c. The 10-kV, 45 cycles three-phase system will soon disappear altogether, for the remaining Avezzano-Sulmona division is now in process of conversion to 3,000-V, d.c. Central European and Scandinavian countries retain the single-phase system for main line work, but important developments of the normal 15- or 16-kV, 16.6-cycles system are in existence in Hungary (16-kV, 50 cycles Kando, with phase-convertor locomotives) and in Germany (20-kV, 50 cycles, with rectifier and Punga-Schön locomotives). Big extensions of the normal single-phase systems have been made in Germany and Sweden during the last two years, and further sections of main line are being electrified. Within the past few months the Norwegian State Railways have added 80 route miles (or 65 per cent.) to their single-phase electrified lines.

The large d.c. mileage in France has been added to by the conversion of the Vierzon-Brive line, 186 miles (1935); Toulouse-Narbonne-Sete line, 167 miles (1935); and the Culoz-Chambery section (22 miles) of the Mont Cenis international route (1936). By this route it is possible to travel from Culoz to Leghorn, *via* Turin and Genoa, a distance of 368 miles, by electric traction. Extensive conversion schemes now under way in France include the 131-mile double-track Paris-Le Mans line of the French State Railways, and the 215-mile Tours-Bordeaux line of the Paris-Orleans Railway. In addition, the route (64 miles) from Narbonne to Port Bou, at the Spanish frontier, is being electrified at the standard 1,500-V, d.c.

A further big extension of 1,500-V d.c. traction is proceeding in Holland with the conversion of the Amsterdam-Eindhoven and the Hague-Arnhem main lines, comprising 157 route miles. In Italy the great southward extension from Naples to Reggio Calabria is to be opened in May, 1937, and the coast line from Leghorn to Rome by the end of that year. The first portion of the 3,000-V d.c. network of the Polish State Railways will be opened early in 1937, and will be followed, further east, by the first electrified main line out of Moscow. A feature of recent electrification schemes on the Continent has been the widening application of multiple-unit streamlined trains both on single-phase and d.c. systems, *e.g.*, Germany, Italy, and Holland. Another feature on d.c. lines has been the almost exclusive use of rectifier sub-stations.—B.R.

ELECTRIFIED RAILWAY MILEAGE IN EUROPE.

Country.	Total route miles open.	Route miles electrified.	Route miles under conversion (*a*) or projected (*b*).	Systems of electrification.
Austria ...	4,400	592	196 (*b*)	16-kV, s.p.
Belgium ...	6,900	36	—	3,000-V, d.c.
Czechoslovakia .	8,400	30	—	1,500-V, d.c.
Denmark ...	3,300	24	—	1,500-V, d.c.
Esthonia ...	900	5	—	1,500-V, d.c.
France ...	33,300	1,752	410 (*a*)	1,500-V, d.c. (1).
			135 (*b*)	
Germany ...	36,450	1,542	220 (*a*)	16-kV/20-kV, s.p. (2).
Great Britain ...	20,400	667	85 (*a*)	600-V/1,500-V, d.c.
Holland ...	2,325	146	157 (*a*)	1,500-V, d.c.
Hungary ...	5,950	224	—	15-kV, s.p. (3).
Italy	14,000	3,185	375 (*a*)	3,000-V, d.c., and
			300 (*b*)	3,700-V, t.p.
Norway ...	2,400	223	20 (*a*)	15-kV, s.p.
Poland ...	13,400	—	60 (*a*)	3,000-V, d.c.
Spain	10,500	376	70 (*a*)	1,500-V and 3,000-V, d.c.
Sweden ...	10,500	1,770	400 (*a*)	15-kV, s.p.
Switzerland ...	3,150	1,870	20 (*a*)	15-kV, s.p. (4).
Russia (5) ...	53,000	550	500 (*a*)	1,500-V and 3,000-V, d.c.

(1) 94 miles at 600/650-V, d.c. (2) 170 miles at 650 to 1,000-V, d.c. (3) 32 miles at 12-kV, single-phase. (4) 70 miles d.c. (5) Including territory in Asia.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Abertillery.—December 31st. U.D.C. Meters and lamps. (December 11th.)

Australia.—BRISBANE.—January 20th. City Electric Light Co. 11,000-V and 415-V, indoor type switchgear. (T.Y. 30988.)*

Bexhill.—Corporation. One crude oil engine, two generators, one switchboard, two electrically driven surface pumps, one electrically driven bore-hole pump, and one air starting set at the Sweet Willow Wood pumping station. E. Pollard, water engineer, Town Hall.

Bristol.—January 11th. Corporation. H.v. switchgear and l.v. sub-station switchgear. (See this issue.)

Chiswick and Ealing.—December 22nd. Hospitals Committee. Electric wiring of new Maternity Hospital, Perivale. (December 11th.)

Dumbarton.—January 18th. County Council. Electrically operated swingbridge over the Forth and Clyde canal, Auchenstarry. Crouch and Hogg, 17, Lynedoch Street, Glasgow, C.3 (deposit £5 5s.).

Eastbourne.—January 14th. Electricity Committee. Stores for twelve months; wiring installations; and reconditioning of cookers, water heaters and wash boilers. (December 11th.)

East Ham.—January 4th. Corporation. Mercury discharge lamps, lanterns, brackets, poles, &c., for lighting of certain main roads. (See this issue.)

Egypt.—CAIRO.—February 2nd. Ministry of Public Health. H.v. transmission line to the Fayoum drainage sewage purification works. (T.Y. 30977.)*

Erith.—January 4th. U.D.C. Electricity Department. Cable. (See this issue.)

Fife.—December 28th. County Council. Electric lighting at twenty houses at Leuchars. J. Gentles & Son, Central Chambers, Kirkcaldy (deposit £1 1s.).

Great Yarmouth.—January 2nd. Borough Council. Cable. (December 11th.)

Halifax.—December 21st. Education Committee. Electric lighting at Lee Mount schools. D. T. Lloyd Jones, borough engineer, Crossley Street.

Hastings.—December 24th. Electricity Department. Kiosk with h.v. and l.v. control for transformer. (December 4th.)

Hendon.—December 29th. Corporation. Electrical installations in branch public library, open air swimming pool, maternity and child welfare centre, and school. (December 11th.)

Heston and Isleworth.—January 4th. Electricity Department. Switchgear and modifications to 11-kV switchboard. (See this issue.)

India.—NEW DELHI.—January 12th. Stores Department. Motor generating sets. (T.Y. 30982.)*

Irish Free State.—DUBLIN.—December 21st. Dublin United Tramways Co. (1896), Ltd. General stores for twelve months, including cables, electric lamps and fittings. Company's offices, 59, Upper O'Connell Street (2s. 6d.).

ELECTRICITY SUPPLY BOARD.—January 8th. P.i. cables. (December 4th.)

Kidwelly.—January 1st. Borough Council. One electrically driven centrifugal pump (2,500 gal. per hr.). Borough surveyor, Borough Offices.

Kirriemuir.—December 31st. Town Council. Electric lighting at thirty-five houses. Lowe & Barrie, Bank of Scotland Buildings, Bank Street (deposit £1 1s.).

Lincoln.—January 8th. Electricity Department. Switchgear and transformers. (See this issue.)

London.—ISLINGTON.—January 13th. Borough Council. Electrical and engineers' stores for one year. (December 4th.)

January 1st. West of India Portuguese Guaranteed Railway Co. Five 3-ton electric level luffing wharf cranes. L. G. Bourchier, secretary, 4, Coleman Street, E.C.2 (deposit £1, not returnable).

HAMMERSMITH. — January 14th. Electricity Department. Switchgear, transformer kiosk and transformers. (See this issue.)

Middlesex.—January 18th. County Council. Electrical installations at the new Technical Institute, Twickenham. (December 11th.)

January 25th. Engineering works, comprising electric lighting, power, bells, telephones and clocks, at the new Children's Home, Dobbs Corner, East Bedfont. (See this issue.)

Milford Haven.—December 30th. U.D.C. Electricity Committee. Cable, switchgear, transformers, rectifier, distribution gear and remote control supervisory gear. (December 4th.)

New Zealand.—WELLINGTON.—January 11th. Posts and Telegraph Department. Telephone cable. (T. 30975.)*

January 12th. Cadmium copper wire. (T. 30973.)* Insulators. (T. 30974.)*

January 13th. Galvanised wire. (T. 30971.)*

January 20th. Insulated copper wire. (T.Y. 30972.)*

February 10th. Dry cells. (T. 30997.)*

February 2nd. Public Works Department. Transformers. (T.Y. 30998.)*

Paisley.—December 21st. Corporation. Electrical installations at housing estates. Master of Works' Office, 16, Gilmour Street.

Queensbury.—December 31st. U.D.C. Electrically driven booster pumping installation for water supply to 154 houses. J. N. Wood, consulting engineer, Waterworks Engineer's Office, Devonshire Street, Keighley.

Risca.—December 21st. U.D.C. Various goods, including electrical fittings and materials for six months. Electrical engineer, Gas Works.

Sheffield.—January 11th. Electricity Committee. Transformers. (See this issue.)

Solihull.—December 28th. U.D.C. Electrically driven, vertical spindle, centrifugal pumps, with motors, switchgear, electric wiring, &c., for the Purnell's Brook sewerage, Knowle. R. Dunn, engineer and surveyor, Council Offices, Streetsbrook Road.

Southport.—January 18th. Southport and District Water Board. Two electrically driven centrifugal deep-well pumps. Engineer and manager, 14, Portland Street (deposit £3).

South Shields.—December 22nd. Corporation. Cable. (December 11th.)

Stone (STAFFS).—December 19th. U.D.C. Erection of an electrical transmission line at Cocknage. Electricity Department, High Street.

Sutherland.—January 9th. County Council. Electric lighting in twenty-two houses at Golspie, Bonarbridge and Embo. E. W. Brannon, architect to the local authority, Dornoch.

Swindon.—December 31st. Great Western Railway Co. Various stores, including electrical conduit, fittings, &c., for a period from February 1st. Stores superintendent.

Uruguay.—MONTEVIDEO.—January 29th. State Electricity Supply and Telephones Administration. 100 single-pole automatic circuit-breakers. (T.Y. 30984.)*

Weobley (HEREFORD).—January 11th. R.D.C. Plant, including a high-speed, high-lift, centrifugal pump (2,000 gal. per hr.), with electric motor and automatic operating gear, for the Weobley water supply. W. H. Grout, clerk to the Council (deposit £2 2s.).

West Riding.—December 31st. County Council. Electric lighting and l.p. hot water apparatus at the extensions of the Hemsworth West End Council school and electric lighting at Wickersley new junior and infants' school. Education officer, County Hall, Wakefield.

Whitley and Monkseaton.—U.D.C. Internal telephone system at the Council Offices. A. J. Rousell, surveyor, Council Offices, Whitley Bay.

Worthing.—January 6th. Borough Council. Street-lighting equipment, including concrete lamp columns and time switches. (See this issue.)

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* Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Barrow-in-Furness. — Electricity Committee. Accepted. Ninety reinforced concrete lamp columns (£385).—Revo Electric Co. Switch panel (£232).—Johnson & Phillips. Four 300-kVA transformers (£187 each).—British Electric Transformer Co. Six transformer kiosks (£1,991), two switch cubicles (£367), and 150-kW water wheel type alternator (£668)..—Met-Vick. Elecl. Co. 230-b.h.p. turbine (£750).—Gilbert Gilkes & Gordon.

Brighton.—Electricity Committee. Accepted. Fire protection equipment for the Southwick power station (£2,173).—Mather & Platt.

Dewsbury.—Town Council. Accepted. Wiring ninety-four houses at Earlsheaton (£499).—J. Shepley.

Dufftown.—Town Council. Accepted. Street lighting by electricity (£844).—Laurie & Co. Wiring Council houses (£230).—W. MacKinnon.

East Ham.—Cleansing Committee. Accepted. Electric vehicle batteries.—D. P. Battery Co. (£208); Chloride Electrical Storage Co. (£209).

Fife.—County Council. Accepted. Electric lighting at housing estates.—Miller & Stables (£291); J. Scott & Co. (£246); R. Aitken & Co. (£183).

Glasgow.—Cleansing Committee. Accepted. Extension to the battery charging plant at refuse power works garage, Govan.—G.E.C. (£1,037); Crompton Parkinson, Ltd. (£578).

Electricity Committee. Accepted. Switchgear for the Dalmarnock power station (£5,311).—Switchgear & Cowans, Ltd. Transformers: Four 800-kVA.—British Electric Transformer Co.; Fourteen 800-kVA.—Bruce Peebles & Co.

Housing Committee. Accepted. Electrical installations at eighty-six houses (£370).—A. & C. Edelman, Ltd.

Transport Committee. Accepted. L.c. cable.—Craigpark Electric Cable Co. Copper bonds.—B.I. Cables, Ltd. Vacuum cleaner.—Sturtevant Engineering Co. Motor and truck equipments.—Brush Electrical Engineering Co.; Met.-Vick. Electl. Co.

Grays.—U.D.C. Accepted. Stand-by electrical equipment at the Tilbury main drainage works (£750).—Laurence Scott & Electromotors.

Hastings.—Electricity Committee. Recommended. Transformers.—Lindley Thompson Transformer & Service Co. (£675); Ferranti, Ltd. (£1,525).

London.—ST. PANCRAS.—Contracts and Stores Committee. Recommended. Installation at the new Electricity Department building, Georgiana Street (£330).—Sims & Sims. Electric-discharge lamps and fittings required for the improvement

of the lighting in Euston Road (£7.9.3 per lamp and fittings).—Siemens Electric Lamp & Supplies, Ltd. Two additional 750-kVA transformers as an extension of the existing contract (£392 each).—Fuller Electrical & Manufacturing Co. Modification of switchgear at the King's Cross and York Road substations (subject to the London and North-Eastern Railway Co. agreeing to the necessary modifications) (£343).—A. Reyrolle & Co. Electricity meters (extension of existing contract).—Chamberlain & Hookham, Ltd.

SOUTHWARK.—General Purposes Committee. Telephone installation at Town Hall:

	Dialling system installation cost.	Extra cost for executive controls (4) and loudspeakers.	Installation cost, direct wire system.
Reliance Telephone Co.	£497	E.c. £26 each L.s. £26 ,,	—
Standard Telephones & Cables ...	£531	L.s. £30 ,,	—
Ericsson Telephones	£515	L.s. £26 ,,	£725
Automatic Electric Co. Recommended	**£530**	**E.c. £26 ,,** **L.s. £26 ,,**	—
E. Shipton & Co.	£472	L.s. £30 ,, E.c. £30 ,,	£454
Basinghall Electric Co.	£502	L.s. £23 ,, E.c. £23 ,,	—
B. French	£542	E.c. £27 ,, L.s. £27 ,,	£475
T. Clarke & Co.	£492	E.c. £26 ,, L.s. £26 ,,	£590
E. H. Witham & Son	£575	E.c. £26 ,, L.s. £26 ,,	—
Dictograph Telephones	—	—	£545

Cables.—Connollys (Blackley), Ltd.; Metropolitan Electric Cable Co.; Telegraph Construction & Maintenance Co.

HAMMERSMITH.—Electricity Committee. Rising and submains in forty-one blocks of flats to afford lighting, heating and cooking supplies, together with wiring installations for lighting and one utility plug-point in 106 four-room, 132 three-room and eight two-room flats:

	£		£
B. Stevenson	1,551	Sydney Hellyar, Ltd.	2,316
A. E. Mayhew & Co. Recommended	**1,608**	L. T. Hall	2,484
F. W. Twentyman	1,661	W. T. Canning & Co.	2,496
Holliday, Hall & Stinson, Ltd ...	1,857	H. E. Steer	2,563
General Electrical Maintenance Co.	1,961	Smith, Owen & Co.	2,588
Caine Pernot, Ltd.	2,092	J. B. O'Brien	2,794
Cox & Hembrow, Ltd.	2,101	Johnson & Tanner, Ltd.... ...	2,815
Wilkins Electrical Works, Ltd....	2,162	E. P. Willdern	2,850
S. Goodchild	2,213	District Electric, Ltd.	6,637
		D. J. Pay	*2,194

* Incomplete tender.

HACKNEY.—Works Committee. Recommended. New battery for an electric cleaning vehicle (£143 less allowance of £20 for old battery).—Chloride Electrical Storage Co. Contractors for use in connection with the improved lighting scheme for main traffic routes (£1 2s. each).—E. N. Bray, Ltd.

Housing and Town Planning Committee. Electric lighting and power in connection with new buildings on the Nisbet Street housing estate:

	£		£
G. D. Lax	5,022	District Electric, Ltd.	6,883
Holliday, Hall & Stinson, Ltd. ...	5,187	E. Wright & Co.	7,003
F. H. Wheeler & Co. Recommended	**5,695**	Carr Bros.	7,494
W. J. Baker	6,083	D. A. McLarty & Co.	7,579
A. Meckhonick	6,156	Colston Electrical Co.	7,813
John Holder & Co.	6,566	J. H. Plant, Ltd....	8,256

L.C.C.—Housing and Public Health Committee. Recommended. Extension of the existing contract for wiring and fittings for electric lighting, &c., in blocks 7 (part), 8 and 11 of dwellings at Browning estate, Southwark, to include electrical installations in remainder of block 7 of the dwellings (£273).—Jacob, White & Co. Wiring and fittings for electric lighting, &c., in blocks 7 to 11 of dwellings at Rockingham estate, as an extension of the existing contract for electrical installations in block 1 to 5 of the dwellings (£2,737).—A. Meckhonik.

Electric bed lift at the Lambeth Hospital:

	£		£
Marryat & Scot, Ltd. Accepted	**983**	Pickerings, Ltd.	1,105
Waygood-Otis, Ltd.	995	Express Lift Co	1,206
J. & E. Hall, Ltd.	1,082		

Wiring and fittings for electric lighting, clocks and wireless, etc., in block E of the Lambeth Hospital:

	£		£
Samuel Reed and Sons. Accepted	**684**	Pinching and Walton	769
B. French, Ltd.	712	T. Clarke and Co.	771
Archbald Meckhonik	720	G. E. Thomas and Co. ...	845
Gillham and Jones	725	A. Hawkins and Sons... ...	855
Read and Partners, Ltd. ...	767	F. Angell and Co.	924
		F. G. Edey and Co.	930

Swansea.—Electricity Committee. Accepted. 33,000-V outdoor switching sub-station (£3,865).—Callender's Cable and Construction Co.

Tynemouth.—Trade Committee. Accepted. Electrical installation at ice factory (£316).—W. W. Ward & Sons.

Forthcoming Events

Institution of Electrical Engineers.—Monday, December 21st. Institution, London, W.C.2. 7 p.m. Informal meeting. Discussion on "The Maintenance and Conditioning of Electric Cookers." To be opened by Lt.-Col. H. W. Watts.

Institution of Civil Engineers.—Friday, December 18th. Vernon-Harcourt Lecture.

Junior Institution of Engineers.—Friday, December 18th. 39, Victoria Street, London, S.W.1. 7.30 p.m. Informal meeting. Discussion on "Economics in Relation to Engineering." To be opened by Mr. K. W. Willans.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, December 18th. Mining Institute, Newcastle-upon-Tyne. 6 p.m. "The Relationship Between Mechanical Tests of Materials and Their Working Conditions." Mr. N. P. Inglis.

Notes

Our Next Issue

Owing to the Christmas holidays, the ELECTRICAL REVIEW for next week will appear one day earlier than usual. We shall be glad if editorial correspondents and advertisers sending matter for publication will do so promptly.

Northampton Polytechnic Institute

At the annual prize distribution of the Northampton Polytechnic Institute, held on Friday last, Mr. S. C. Laws (Principal), in reviewing the work of the past year, said that the total number of students in attendance during the session 1935-36 was 3,238, an increase of 292 over the previous year. Of these 182 attended the full-time day engineering courses, 1,090 the evening course in electrical engineering, and 702 the evening course in civil and mechanical engineering. In the internal examinations twenty-one students gained National Certificates for electrical engineering and twelve National Certificates for mechanical engineering, while in the external examinations thirty students obtained the degree of B.Sc. (Eng.) of the London University, first-class honours going to three day students and one evening student. Additional accommodation had been provided for the engineering trades, but owing to the expansion of evening classes a fresh scheme of building extensions was under consideration. Mr. H. A. Game (chairman of the governing body), who presided, introduced Mrs. E. M. Lowe, J.P. (chairman of the L.C.C. Education Committee), who in a short address, before presenting the awards to the students, said that a large sum was shortly to be spent by the State on technical education and there was no reason why the Northampton Polytechnic should not benefit. The annual conversazione was held on Saturday.

New Rubber-Cable Classification

Stocks of new C.M.A. grade cables and flexible cords and "Nonazo" class cables will be available, the Cable Makers' Association announces, on January 1st, 1937. The dielectric will consist of three layers of vulcanised rubber compound, that for the "Nonazo" class being of not so high a quality Classification will be by voltage and not by megohms. The two new types are C.M.A. grade 250 V, 660 V and higher voltages and "Nonazo" class 250 V. The former trade names "Vicma" and "Vinazo" will be discontinued. Conductors for C.M.A. grade 250-V cables will have a maximum size of 19/.064 (0.06 sq. in.) instead of 1.0 sq. in., sizes above the first-named being manufactured for 660-V and higher voltages only. In the "Nonazo" class the maximum size for single-core cables will be 19/.064 and for twin and three-core flat lead-covered and flat tough rubber-sheathed cables 7/.064 (0.0225 sq. in.). Only the following finishes will be supplied: (a) single-core, taped, cotton-braided, and compounded; (b) single-core cables will be 19/.064 and for twin and three-core and three-core, flat, lead-alloy sheathed, with earth continuity conductor; (d) single, twin and three-core, flat, tough-rubber sheathed.

The Physical Society's Exhibition

The annual exhibition of scientific instruments and apparatus arranged by the Physical Society will be held at the Imperial College of Science and Technology, South Kensington, from January 5th to 7th. On January 5th Sir James Swinburne will lecture on "Electrical Measurements in the 'Eighties, particularly those associated with Ayrton and Perry," and on the following day Mr. H. Moore will speak on "The Influence of Industrial Research on the Development of Scientific Instruments."

Appointments Vacant

Assistant mains engineer from Fulham Electricity Department.

Electrical engineering assistants in the drawing office for the Air Ministry.

Accountancy and statistical clerk for Shoreditch Electricity Department.

Maintenance engineer at the Town Hall, Luton.

Workshop testers in the wireless-telegraphy and electrical workshops at the R.A.F., Kidbrooke, S.E.

Meter repairer and tester for Hastings Electricity Department.

(See our classified advertisements.)

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

SPREADLIGHT lenses for floodlighting projectors.

FEN-SON hairdryer.

Readers should enclose stamped addressed envelopes when making their enquiries.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Worksop Borough Council has added to the duties of **Mr. M. S. Mason,** the borough electrical engineer, those of publicity officer in charge of industrial development. The first step in this connection is the taking of a stand at the British Industries Fair at Birmingham next February.

Captain D. Shipton Wood, R.E. (T.R.), A.M.I.E.E., A.M.I.Mech.E., recently resident engineer of the Ribble power station, is relinquishing his appointment with the County Borough of Preston Electricity Department at the end of this month.

Mr. L. V. Turner, A.M.I.E.E., who has been acting borough electrical engineer at Taunton since January last, has now been appointed borough electrical engineer at a salary of £800 per annum. Mr. Turner received his training with Newtons, Ltd., Rotax, Ltd., and at the Croydon Corporation electricity works. He had control of a large assembly department at Vickers, Ltd., and after occupying various power station positions was appointed deputy borough electrical engineer at Taunton in 1931. He has lectured for a number of years in electrical engineering at the Taunton Technical Institute.

Mr. L. V. Turner

Mr. G. W. Cornish, a sub-station engineer with the Leicester Corporation electricity undertaking, who has retired after thirty-two years' service, has been presented by Mr. J. Mould, the manager of the undertaking, on behalf of the fellow-members, with a three-piece suite of furniture as a mark of their appreciation.

Mr. C. O. Webb has been appointed a director of the Madras Electric Supply Corporation in succession to the late Mr. F. G. Clarke.

Mr. W. W. Parker, who was recently appointed to the board of Drake & Gorham, Ltd., as employé managing director, joined the company in 1912, and during recent years has played an important part in the development and organisation of its Contracts Department. **Major R. J. Weil,** who also recently joined the board as employé managing director, was educated at Malvern College. In 1914 he joined the 1st Australian Division, transferred to the Royal Artillery, and served in France and Flanders until 1919. He obtained the M.C., and was mentioned in despatches. He is also a director of Electrolumination, Ltd., and a Freeman and Liveryman of the City of London.

Mr. H. L. Pope for thirty years with Johnson & Phillips, Ltd., in the Contracts Department, has now joined the British Central Electrical Co., Ltd., in the capacity of manager of the Purchasing and Despatch Department.

Lord Henley has been elected a director of the Northampton Electric Light & Power Co., Ltd., in succession to the late Mr. F. Kilby.

Ald. Sir Thomas Higham has been re-elected chairman of the Mid-Lancashire Electricity Advisory Board.

Mons. M. R. Gibrat has recently been nominated to the chair of Industrial Electricity at the Ecole Superieure des Mines, Paris, in succession to Mons. Chipart, who recently resigned.

The following gentlemen were present (according to *The Times*' Warsaw correspondent) at the formal opening, on December 15th, of the Warsaw and district electric railway system: Mr. G. H. Nelson, Sir Gerald Talbot, and Mr. H. T. Rice, of the English Electric Co., Ltd.; Messrs. Graty and Peck, of the Metropolitan-Vickers Company; and Mr. C. E. Fairburn, chief of the L.M.S. Railway, who was chief traction engineer of the English Electric Co. when the contract was negotiated in 1933.

Mr. G. R. T. Edwards has been appointed to a senior position in the Engineering Department of the Rangoon Electric Tramway & Supply Co., Ltd., and will be taking up his duties early in the new year. Previous to his appointment Mr. Edwards was assistant technical engineer to the Shropshire, Worcestershire and Staffordshire Electric Power Co.

Mr. C. R. Belling left recently on the ss. *Arundel Castle* for a business trip to South Africa, where he arrived last week.

Mr. T. S. Jones, manager of the electrical department of Messrs. Gardiner, Sons & Co., Ltd., wholesalers, of Bristol, is relinquishing his position at the end of this year in order to take over a district manager's position with the International Refrigerator Co., Ltd., of London, W.1.

Mr. L. E. Wilson, M.I.E.E., of L. E. Wilson & Co., Ltd., Manchester, leaves England on December 26th for the West Indies, Venezuela, and Panama, on a visit to his engineer sons engaged in the oilfields in Trinidad and Venezuela. Mr. Wilson is chairman of the Manchester branch of the Electrical Contractors Association.

Mr. E. L. Colston has been appointed joint managing director of Hoover, Ltd.

Lord Midleton, Deputy Governor of Cable and Wireless (Holding), Ltd., was entertained to lunch by his colleagues on the Court of Directors on December 14th at Electra House, Victoria Embankment, to celebrate his eightieth birthday—and his lengthy connection with overseas telegraphy. Mr. J. C. Denison-Pender, the Governor of Cable and Wireless (Holding), Ltd., who presided, handed to Lord Midleton a Mazer Bowl, designed and executed by Mr. Omar Ramsden, suitably engraved with Lord Midleton's family Coat of Arms. Lord Midleton's association with the communications industry commenced in 1882 when he became a director of the Brazilian Submarine Telegraph Co. In 1894 he was instrumental in uniting several companies, resulting in the formation of the Western Telegraph Co. In addition to serving on the boards of all the companies in the group, he is the chairman of the Globe Telegraph & Trust Co.

Obituary

Sir Herbert Jackson.—We regret to record the death of Sir Herbert Jackson, K.B.E., F.R.S., a pioneer worker on X-rays, which occurred on December 10th at the age of seventy-three. The funeral took place on Tuesday at Hampstead. Sir Herbert was associated with King's College for many years, commencing in 1890. He became an assistant professor in 1902, Professor of Organic Chemistry in 1905, and from 1914-1918 was Darnell Professor of Chemistry. During the war he carried out extensive investigations in the production of glass, and from 1918-33 he was Director of Research of the British Scientific Instrument Research Association. From 1901-1903 he was president of the Röntgen Society (now incorporated with the British Institute of Radiology), and from 1918-1921 he was president of the Institute of Chemistry. At the time of his death Sir Herbert was an honorary member of the British Institute of Radiology, consultant to the British Scientific Instrument Research Association, and Emeritus Professor of Chemistry at the University of London. With regard to his early work in connection with X-ray radiation, it is interesting to record that in the ELECTRICAL REVIEW of April 10th, 1896, we published an account of a lengthy interview with Mr. (as he then was) Jackson. Since 1890 he had been engaged in the Chemical Laboratory at King's College, London, on an elaborate series of researches on phosphorescence, chiefly as produced by the Crookes tube. In the course of our article we stated that quite apart from these researches he had done more, perhaps, than anyone to make X-ray photography a practical success. Sir Herbert received the honour of knighthood in 1917.

[Elliott & Fry.

The late Sir Herbert Jackson

Mr. Andrew Forbes Dick, whose death was announced in our last issue, began at an early age in the National Telephone Service, and reached a position of responsibility before his majority at Berwick-on-Tweed. The experience he gained there in the personal and individual negotiations as engineer, and subsequently manager in regard to wayleaves and other developments in connection with telephone work, stood him in good stead in his later years. From there, after a short service at the Peel-Conner Works, he secured an appointment in the Supplies Department of the British Westinghouse. He accepted an appointment with Mr. A. F. Hobdell, in the firm of Hobdell Way, and rose to the position of managing director. Messrs. Hobdell Way were ultimately absorbed into the Turner & Newall Asbestos and Insulation group, and Mr. Dick followed the Asbestos interests, and was appointed a special director on the Asbestos side. After a short period with this group he joined Boulton & Paul as a special advisory director. Mr. Dick joined the Brush Electrical Engineering Co., Ltd., in the latter half of this year, and was appointed managing director at the Loughborough works, where he

exerted the full powers of his contracting and organising ability in the reorganising and replanning of the works, especially in connection with large contracts in hand for the Brighton Electricity Department. Mr. Dick was in his fifty-eighth year. He was a prominent Freemason. The interment took place at Golders Green Crematorium on December 11th.

Ald. Robert Beresford, whose death is announced at the age of fifty-six years, was in business at Newcastle-under-Lyme as an electrical and radio engineer. He had been Mayor on three occasions.

Will.—Mr. Harry Alfred Richardson, a director of Hick, Hargreaves & Co., left £42,706, with net personalty £39,568.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Radio Rentals, Ltd.—Public company. Registered December 7th. Nominal capital, £250,000 in 150,000 6 per cent. redeemable cumulative preference shares of £1 and 400,000 ordinary shares of 5s. each. Objects: To acquire the undertaking, properties, rights and powers of Radio Rentals, Ltd. (purchase consideration £60,000 in ordinary shares and discharge of old company's liabilities), and to carry on the business of manufacturers, designers, consultants, hirers, renters, repairers, exporters and importers of, agents for and dealers in musical and other instruments of all kinds, including wireless, television, radio, gramophones, cinematograph and phonographic apparatus. The directors are: H. F. Hunt, Cornwall House, Cornwall Gardens, S.W.7, D. Warnford-Davis, Lansdowne House, Berkeley Square, W.1, T. Dunwoody, 5, Eastern Terrace, Brighton, F. W. Shelley, Hamilton House, Piccadilly, W.1, and P. Perring-Thoms, 46, Gilling Court, Belsize Grove, N.W.3 (all directors of Radio Rentals, Ltd., old company). Registered office: 92, Regent Street, W.1.

Radiochron, Ltd.—Private company. Registered December 10th. Capital, £5,100. Objects: To adopt an agreement with G. Briggs, and to use, exercise, exploit, develop, grant licences in respect of and turn to account the inventions and patents comprised therein, and to carry on the business of manufacturers of and dealers in any articles, manufactured in accordance with any inventions, &c. The directors are: G. Briggs, 20, Queensborough Terrace, W.2, and Capt. R. Macdonald-Buchanan, Guilsborough Hall, Guilsborough, Northants. Solicitors: Hunters, 9, New Square, Lincoln's Inn, W.C.2.

Alex. S. Addison & Co., Ltd.—Private company. Registered in Edinburgh December 11th. Capital, £1,500. Objects: To carry on the business of manufacturers, importers and exporters of, dealers in and agents for the sale and purchase of all kinds of electrical and other instruments, &c. The directors are: A. S. Addison, 14, Curling Crescent, Glasgow, S.4, and W. J. R. MacKenzie, 38, Gelston Street, Glasgow, E.2. Registered office: 61, Mount Annan Drive, Mount Florida, Glasgow, S.4.

Croydon Plastics, Ltd.—Private company. Registered December 11th. Capital, £2,500. Objects: To carry on the business of moulding bakelite and other similar materials, &c. The directors are: P. H. George, 35, Barnfield Avenue, Shirley Road, Croydon (managing director), and five others. Registered office: Gloucester Road, Croydon.

Bewicke Radio Services, Ltd.—Private company. Registered December 11th. Capital, £1,000. Objects: To acquire the business of a dealer in wireless receiving sets, &c., now carried on by Samuel J. Henderson, trading as Bewicke Radio Services. The permanent directors are: S. J. Henderson, 13, Station Road, Willington Quay-on-Tyne, and A. G. Clark, 11, Byron Avenue, Willington Quay-on-Tyne. Registered office: 19, Saville Row, Newcastle-on-Tyne.

Radio Merchandise Co., Ltd.—Private company. Registered December 12th. Capital, £100. Objects: To carry on the business of dealers in and distributors of wireless, television and electrical apparatus, &c. The subscribers are: B. Morris, 94, Anson Road, N.W.2, and L. Levenberg, 80, Ernest Street, Mile End, E.1. B. Morris is first director. Registered office: 287, City Road, E.C.1.

Kingsdown Electrical Co., Ltd.—Private company. Registered December 11th. Capital, £100. Objects: To carry on business as electrical engineers and general electrical installation contractors, &c. The directors are: G. M. Pritchard, 422, Brighton Road, South Croydon, and E. G. Willoughby-Gee, "Beam End," Coulsdon Road, Old Coulsdon.

Carrier Weathermakers, Ltd.—Private company. Registered December 12th. Capital, £20,000. Objects: To adopt an agreement with the Carrier Engineering Co., Ltd., for the distribution and sale of air conditioning appliances, apparatus and equipment of that company. The directors are: S. L. Groom, Chatesgrove, Bolney, Sussex (director of Carrier Engineering Co., Ltd.), and A. G. Defries, 23, Hillfield Court, Belsize Avenue, N.W.3. Secretary: H. S. Sheffield, 448, Strand, W.C.2.

Radio Traders, Ltd.—Private company. Registered December 9th. Capital, £100. Objects: To carry on the business of merchants of, agents for and dealers in wireless apparatus and electrical instruments and accessories, &c. The directors are: A. Woolf, 33, Somerford Houses, Bethnal Green, E.2, and I. Woolf, 11, Belvedere Road, Leyton, E.10. Registered office: 109, Vallance Road, E.1.

Returns of Electrical Companies

East Midland Electrical Co., Ltd.—Capital, £1,500 in £1 shares. Return dated September 30th, 1936. 750 shares taken up. £750 paid. Mortgages and charges: £3,000.

Wessex Ignition Co., Ltd.—Capital, £100 in £1 shares. Return dated November 6th, 1936. All shares taken up. £2 paid, £98 considered as paid. Mortgages and charges nil.

Chadburns (Ship) Telegraph Co., Ltd.—Capital, £120,000 in £60,000 ordinary stock and 60,000 shares of £1. Return dated July 23rd, 1936. £60,000 ordinary stock taken up. £60,000 paid. Mortgages and charges nil.

Glynceiriog Electricity Supply Co., Ltd.—Capital, £1,500 in £1 shares. Return dated September 24th, 1936. 1,000 shares taken up. £1,000 considered as paid. Mortgages and charges nil.

W. Mackie & Co., Ltd.—Capital, £12,000 in £1 shares. Return dated October 1st, 1936. 7,500 shares taken up. £3,155 paid, £4,345 considered as paid. Mortgages and charges nil.

Bush Radio, Ltd.—Capital, £2,500 in £1 shares. Return dated November 19th, 1936. All shares taken up. £2,500 paid. Mortgages and charges: £55,000.

L. Nicholson & Co., Ltd.—Capital, £6,000 in 6,000 ordinary shares of £1. Return dated July 21st, 1936. 4,550 shares taken up. £952 paid, £3,598 considered as paid. Mortgages and charges nil.

Claude Lyons, Ltd.—Capital, £500 in 500 ordinary shares of £1. Return dated August 11th, 1936. All shares taken up. £350 paid, £150 considered as paid. Mortgages and charges nil.

Bristol Tramways & Carriage Co., Ltd.—The nominal capital has been increased by the addition of £200,000 in £1 ordinary shares beyond the registered capital of £2,000,000.

Wm. G. Walter (Bath), Ltd.—The nominal capital has been increased by the addition of £3,000 beyond the registered capital of £8,000. The additional capital is divided into 3,000 5½ per cent. cumulative preference shares of £1 each.

West Devon Electric Supply Co., Ltd.—Capital, £350,000 in 100,000 6 per cent. cumulative preference and 250,000 ordinary shares of £1. Return dated June 10th, 1936. All shares taken up. £286,513 paid on 88,000 preference and 198,513 ordinary shares, £63,487 considered as paid on the remainder. Mortgages and charges nil.

Turner & Booth (Southport), Ltd.—Debenture charged on the company's undertaking and property, including uncalled capital, dated November 17th, 1936, to secure £500. Holder: Ernest W. Turner, 114, Church Street, Radcliffe, Lancs.

City Notes

Vactric, Ltd., held its second annual meeting on Tuesday last, when Mr. F. Kingsley Tubbs (chairman), who presided, said that the turnover for the year showed an increase over the previous year, but, owing to a rise in selling costs due to the much larger number of small orders obtained, the net profit was only slightly higher than in 1935. Agreements between the Vactric Company and the Apex Electrical Manufacturing Co., of Cleveland, were substantially settled. These provided for the formation of a concern in this country, intended to be called Apex-Vactric, Ltd., which would be a subsidiary to Vactric, Ltd., the latter having a controlling interest. The new company would purchase products and parts, other than vacuum cleaners, from the Apex Company and have the right to use Apex patents in the area covered by the English company. Vactric, Ltd., itself would deal with Apex vacuum cleaners. Additional factory accommodation was to be provided and terms for a site had almost been agreed upon. Apex-Vactric and the parent company were to be operated from the same factory and address and would be treated as a single unit. While the new factory was being erected the Apex Company of America would send over any stock required. The new developments would necessitate additional capital and an issue would be made of further ordinary shares to existing ordinary shareholders. The offer would be one ordinary share at 15s. per share in respect of every two ordinary shares now held. The meeting to make this issue possible would take place on December 29th. A new electric vacuum cleaner, produced by Vactric, Ltd., was to be introduced to the market next month.

R. A. Lister & Co., Ltd.—Presiding at the annual meeting held last week, Mr. P. Lister (chairman) said that work had commenced on the building of the new foundry, which was to be equipped with the latest plant and machinery. During the year under review they had purchased the business of Blackstone & Co., and already progress had been made with the reorganisation and development programme at the Blackstone Works at Stamford. While they continued to contribute towards the problem of national defence, this was not the primary cause of their expansion. On the contrary, a satisfactory indication was the expansion of their normal trading in the home and overseas markets. In addition to the normal developments of the past year they had introduced the "Listard" process, and over a hundred firms in the engineering industry had inquired for licences under this process. The subsidiary companies had also shown encouraging results. With regard to the future the unsettled economic and political conditions in many parts of the world made any forecast impossible, but they looked forward with confidence.

The India Rubber, Gutta Percha and Telegraph Works Co., Ltd., held its annual meeting on December 11th, when Sir Walrond Sinclair (chairman), in the course of his speech said that all the ordinary capital and nearly 95 per cent. of the preferred capital was held by the British Tyre & Rubber Co. It was a source of satisfaction to them that only three years after their first association with that company, during a period of reorganisation which even now was not completed, they should have progressed so far from losses to profits as to have such a surplus available for distribution. The rebuilding and re-equipment programme at their Silvertown works had so far proceeded smoothly and a substantial part of the work was already completed. Work would continue throughout 1937, and some stages would involve the most difficult problems they had to face in avoiding dislocation of production. Satisfactory progress had been made with the improvements to the factory in Buenos Aires, which continued to operate profitably, although competition from other local factories was becoming increasingly severe. Despite the difficulties arising from the rebuilding activities, they had been able to achieve an appreciable increase in turnover. Keen competition, however, had resulted in low selling prices despite increased costs of raw materials.

Thorn Electrical Industries, Ltd.—The lists were to open yesterday (Thursday) for an offer for sale of 50,000 6 per cent. cumulative preference shares of £1 each at 21s. per share and 266,668 ordinary shares of 5s. each at 11s. 3d. per share. The company was incorporated in 1928 under the title of the Electric Lamp Service Co., Ltd., and carries on, in conjunction with two subsidiaries, the business of manufacturers of Atlas electric lamps and dealers in electrical and radio goods, with a factory at Edmonton equipped for the manufacture of electric lamps of all types. A new building is being completed in which additional plant and machinery required to meet the increasing demand will be installed. Profits rose from £11,900 for the year ended March 31st, 1934, to £43,400 for 1935-36. Allowing £6,350 to cover directors' fees and management remuneration and other administrative expenses, the profit for last year is sufficient to cover the preference dividend over twelve times. The directors of the company are Messrs. J. Thorn (chairman and managing director), A. Deutsch, H. M. Graham, and A. W. Kingsley.

General Cable Manufacturing Co., Ltd., held its annual meeting on Monday last, when Mr. C. W. R. Pantlin (chairman), who presided, referred to the increase in the cost of raw materials and said that the prices of copper, rubber and lead, which played a large part in their manufacturing, had risen during the year in the aggregate by 22 per cent. Unfortunately, selling prices had shown little advance. Accordingly, they had concentrated upon expanding sales and had achieved a record turnover, which had enabled them to show an advance in profits. During the summer months they had decided to construct another shop and install additional plant to cope with increasing business; the new plant should be in operation in January. They viewed the future with confidence, especially as it seemed likely that the uneconomical price-cutting in the rubber cable trade might be coming to an end.

Radio Rentals, Ltd.—The subscription list was to open yesterday (Thursday) for an issue of 100,000 5½ per cent. redeemable cumulative preference shares of £1 each at par and 100,000 ordinary shares of 5s. each at 7s. per share. The company has been formed to take over as from September 1st, 1936, the business of the same name. Its business consists mainly of the renting to subscribers under contract of radio receiving sets manufactured by E. K. Cole. During the last financial year there has been a net increase of over 12,000 subscribers. The proceeds of the issue will enable loans and advances to be repaid and provide £74,500 additional working capital for extending the business in the North of Scotland.

British Vacuum Cleaner & Engineering Co., Ltd.—Presiding at the annual meeting held on Monday last Mr. H. C. Booth, chairman and joint managing director, said that the year under review had been a record one for turnover and profits. To cope with increased sales of vacuum cleaners they had completed the extension of the works referred to last year and had also acquired additional freehold premises. They were now in a position to meet present requirements and prospective future developments. Plans for broadening the scope of the business were also under consideration. During the past year they had established a wholly-owned subsidiary company in Canada, and operations to date had been successful and profitable.

Dictograph Telephones, Ltd.—The lists opened on Tuesday last for an offer for sale by the Whitehall Industrial Trust of 2,000,000 ordinary shares of 2s. each at 2s. 3d. per share in Dictograph Telephones, Ltd. The company has acquired the business of D.T.L., formerly called Dictograph Telephones, incorporated in 1914. The business consists mainly in the installation and maintenance of internal telephones. The installations are sold for cash, on hire-purchase terms, or are rented. The orders obtained during September, October and November, 1936, are in excess of those for the corresponding period of 1935, and the total orders in hand is the highest on record in the history of the business.

Associated Gas & Water Undertakings, Ltd., has acquired the majority interest in the Chesham and District Gas Co. A meeting is to be held on January 1st at which a resolution will be submitted for increasing the capital to £2,500,000 by the creation of 1,500,000 new £1 shares, of which 750,000 will be ordinary shares and 750,000 will be irredeemable cumulative preference shares. Offers have recently been made by the directors to purchase a controlling interest in the Yorktown (Camberley) and District Gas and Electricity Co., the Guildford Gas Light & Coke Co., and the Farnham Gas and Electricity Co.

The Isle of Thanet Electric Supply, Ltd., is holding an extraordinary meeting on January 4th at which a proposed Bill in Parliament will be considered. The Bill is promoted for the purpose of giving legal effect to an agreement (dated August 16th, 1936) between the Margate Corporation and the Broadstairs and St. Peter's U.D.C. and the company, whereby the present options of the local authorities to purchase the several portions of the company's electricity undertaking in the years 1938, 1941, 1943 and 1966 are synchronised and all become operative in the year 1945, with recurring options every ten years thereafter; the terms of the purchase as at such dates and other incidental matters are also provided for.

Yarrow & Co., Ltd., held their annual meeting on December 9th, when Sir Harold E. Yarrow (chairman and managing director) in the course of his speech said that the boiler department had been busy during the year and important orders had been received, including one for six Yarrow boilers and complete boiler-house equipment for the Glasgow Corporation. These boilers would be among the largest in the country. Another important order that had recently been received was for a number of Yarrow boilers for one of the large power stations in London, this being a repeat order.

The Brazilian Traction Light & Power Co., Ltd., has declared a dividend of 40 cents per share on the ordinary shares of no par value. Payment of this dividend to non-residents of Canada will be subject to deduction of the Canadian income-tax of 5 per cent. This dividend makes 70 cents per share for 1936. No payment was made in the three years to December 31st, 1935.

The Victoria Falls & Transvaal Power Co., Ltd., has declared a dividend of 3 per cent. for the half-year on the preference shares, and a further dividend of 4 per cent., being the participating rights for the year ending December 31st, 1936. The interim dividend on the ordinary shares is maintained at 4 per cent.

Mann, Egerton & Co. report a net profit for the year ended September 30th of £30,460, as compared with £33,319 in the preceding year. It is proposed to pay a dividend of 17½ per cent. on the ordinary shares, to place £7,500 to general reserve, and to carry forward £16,120.

The Compania Hispano Americana de Electricidad (Chade) is paying an interim dividend of 20 Argentine paper pesos in respect of shares of the series "A," "B," and "C," and four Argentine paper pesos in respect of shares of the series "D" and "E."

Edmundsons Electricity Corporation, Ltd., reports that the results of the operations of its group of companies during November as compared with the corresponding month of 1935, show an increase of 15 per cent. kWh sold.

The Palestine Electric Corporation, Ltd., is maintaining the interim dividend on the ordinary and "A" ordinary shares at 2½ per cent., free of U.K. tax.

The English Electric Co., Ltd., has decided to pay the arrears of dividend on the 6½ per cent. cumulative preference shares in respect of the years 1934 and 1935.

Stocks and Shares

TUESDAY EVENING.

STOCK Exchange markets can be said to have settled down into a condition more approaching the normal than obtained during the course of the previous week. What disturbance was then caused to confidence and quotations has been almost forgotten in the steady absorption of stocks and shares on the part, mainly, of investment. The approach of Christmas and New Year is having the usual effect of curtailing business to some extent, though it must be said that in a number of markets round the House the volume of trade now being handled is greater than usual at this particular season.

Most of the falls which occurred have been recovered. The Continental holders of British Government securities seem to have got over the slight attack of nerves which affected them ten days ago. Industrial companies are showing, on the whole, excellent results. Rises in the commodity market and in base metals confirm the cheerfulness of holders of stocks and shares in the companies interested. New issues continue to be poured out with a generosity which implies the promoter's belief in an abundance of money assumed to be awaiting investment.

For the first time in its history the Stock Exchange introduced loudspeakers into the House for the broadcasting of the Speaker's announcement to the House of Commons when he read the abdication statement made by the recent King. The experiment proved so successful that it is likely to be repeated upon some further occasion, though not, it may be hoped, one of the same nature.

Electricity Supply Shares

Practically the whole of the two classes of ordinary capital of the Shropshire, Worcestershire and Staffordshire Electric Company, which has just declared interim dividends at the same rate as last year's, is in private hands: Edmundson's Corporation holds a major interest. The 6 per cent. preference shares can be bought at 31s. 6d., to give a yield of £3 16s. on the money; the dividend was covered approximately 3½ times over by last year's profits.

Price movements in the market for home electricity supply shares have been, during the past week, few and unimportant. The occasional minor losses which took place during the period of uncertainty have mostly been recovered, in part at least. In the foreign group, Palestine "A" were sought after at their lower level, and improved in price from 45s. to 46s. 9d., ex dividend. Perak Hydros, too, after a spell of weakness, are decidedly better, at 32s. 6d.

Manufacturing and Equipment Shares

Solution of the constitutional problem, and consequent relaxation of anxiety, found the electrical equipment market in mildly responsive mood. General Electrics gave a lead, in

stiffening to 92s., and Associated Electricals recovered well to 52s.; but, except where special considerations entered, prices generally were content to remain slightly on the dull side. A recovery, to 16s. 6d., in Enfield Rolling Mills is one of the week's few features. Others to show improvement were Switchgear and Cowans, now 20s., Strand Electric Holdings 8s., Laurence Scott "A" 11s. 9d., and India Rubber preference 23s. 3d., the last mentioned being bought on the recently published results. Telegraph Constructions, in falling to 33s. 9d., lost their lead over Siemens, which are firm at 35s. Crompton Parkinsons, at 3⅛, are quoted ex dividend, but still cum-rights to the bonus distributions. The price went back a little after the annual meeting. Ever Ready, at 30s., and Lissen preference, 22s. 6d., remained unmoved by the former company's decision to put into effect its tentative offer to holders of the latter. Ismay Industries are 8s., ex rights to the new shares; the latter, offered at 7s. 6d., are quoted at 3d. premium.

English Electric

English Electric issues came into strong request on news of the company's decision to pay off two years' preference dividend arrears. The price of the preference, at 26s. 6d., ex dividend, recovered all but 6d. of the dividend deduction. The ordinary shares jumped half-a-crown, to 28s. 6d. The payment, calling, as it does, for a sum of £148,000, or £18,000 more than the total net profits earned in 1935, is naturally taken as a sign that the improvement, noticeable in the 1935 results, has become more consolidated during the financial year which is now almost ended. The figures for 1936 will be awaited with an interest whetted by this latest development. The speculatively minded are busy calculating the chances of a distribution to ordinary shareholders. This year's preference dividend remains to be paid, but there are supporters for the view that no difficulty will be experienced in meeting this charge, with a useful margin to spare. Optimism is, however, tempered by realisation of the desirability of strengthening a financial position which has been weakened by the succession of lean years, and which may dictate a cautious policy in the distribution of profits. Prospects in this direction have, however, been improved by this year's conversion scheme that will effect an annual saving, in debenture interest, of £10,000.

Crabtree and Walsall

Allottees who were disappointed with the meagreness of their results from the Crabtree Electrical Industries offer have substantial compensation in the premium which has piled up on the issue price of 12s. 9d. for the 10s. ordinary shares. Dealings began at a hot pace on Monday of last week: those who were not tempted out of their allotments in the early stages saw the price doubled in value before the week was out. The shares are still in request at over 28s. To a buyer at that price, the earnings yield, calculated on the basis of last year's profits, works out at a little under 8 per cent.

Walsall Conduit 4s. ordinary, issued a week or so before the Crabtree offer, are still inclined to hang fire, the price remaining around the prospectus price of 32s. 6d. The prospective yield on earnings in the current year is, here also, round about 8 per cent. The 5 per cent. preference shares of the Walsall company stand at 23s. and those of Crabtree Industries at 22s. 6d. The issue price in each case was 20s. 6d.

The electrical equipment market has another newcomer in Thorn Electrical Industries, which company has been making an offer this week of 5s. ordinary shares at 11s. 3d. and 6 per cent. preference shares at 21s.

Brazilian Traction

The dividend of 40 cents per share on Brazilian Traction Light and Power ordinary shares is the second cash distribution to be declared in the last six months, and makes with last July's payment a total distribution of 70 cents for the year. Previously no cash payment had been made for four years. The price of the shares, which are of no par value, was stimulated by the announcement to rise ⅝ to 18¾. The price of Brazilian Tractions was in single figures near the beginning of this year. The rapid appreciation is due to improvement in local business conditions and to the easing of currency restrictions. This last named has facilitated the transfer of funds out of the country and presented "foreign" shareholders with tangible testimony to these factors. The market is cautiously hopeful of a resumption of regular quarterly cash payments, a basis of 25 cents per quarter being suggested as a possibility.

Miscellaneous Matters

Removal of uncertainty regarding next season's Coronation celebrations helped the price of London Transport "C" stock to regain a point of the recent decline and that of British Electric Traction deferred to rise 50 points to 1625. The price of Telephone Properties has relapsed from 10s. to 8s. 9d. since the decision to postpone consideration of a dividend until the full accounts are available. Last year an interim dividend of 2 per cent. was declared in October and was followed by a final payment of 3 per cent. Continued lack of interest in Cable and Wireless stocks left the price of the preference only half a point over par. Globe Telegraph preference came back further to 14½. Rubber shares respond in sober fashion to the improved technical position of the commodity.

Share List of Electrical Companies

	Nom.	Dividend. Previous.	Dividend. Last.	Price. Dec. 15.	Rise or Fall.	Yield. p.c. £ s. d.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	77/6	—	3 17 5
City of London	1	7½	7½	36/6	—	4 2 1
Clyde Valley	1	7	8	45/6	—	3 9 7
County of London...	1	10½	10½	53/6	—	3 18 6
Edmundson's 7% Pref.	1	7	7	35/6xd.	—	3 18 9
Do. Ord.	1	8	8	44/6	+6d.	3 12 0
Elec. Dis. Yorkshire	1	9	9	45/–	—	4 0 0
Elec. Fin. and Securities	1	12½	12½	3⅛	—	4 1 7
Elec. Supply Corporation ...	1	11	11	58/3	—	3 15 7
Lancs Light and Power	1	7½	7½	38/–	—	3 19 0
Lond. Assoc. Electric	1	—	7	35/–	—	4 0 0
London Electric	1	7	8	40/–	—	4 0 0
London Power Deb. Red. ...	Stock	5	5	107½	—	4 13 0
Metropolitan	1	10	10	50/6	+6d.	3 19 2
Midland Counties	1	7	7½	39/6	—	3 16 0
Mid. Elec. Power	1	8	8	41/3	—	3 17 7
North Eastern Electric Ordinary	1	6	6	32/6	+6d.	3 13 10
Do. 7% Pref.	1	7	7	35/–	—	4 0 0
Northampton	1	10	10	51/3	—	3 18 2
Notting Hill 6% Pref.	10	6	6	14½xd.	—	4 4 3
North Met. Elec. Ordinary ...	1	10	10	55/6	+6d.	3 12 0
Do. do. 6% Pref. ...	1	6	6	32/–	—	3 15 0
Scottish Power	1	8	8	41/–	—	3 18 2
South London	1	7	7	34/6	—	4 1 2
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	22/–	+6d.	6 19 8
Yorkshire Elec.	1	8	8	44/6	+6d.	3 12 0
PUBLIC BOARDS.						
Central Electricity, 1950–70 ...	Stock	5	5	120	—	4 3 5
Do. 1955–75 ...	„	5	5	122	—	4 2 0
Do. 1951–73 ...	„	4½	4½	113	—	3 19 8
Do. 1963–93 ...	„	—	3½	103	–1	3 8 0
London Elec. Trans. Gtd. ...	„	—	2½	94½	—	2 13 0
London & Home Counties, 1955–75	„	4½	4½	116	—	3 17 7
London Passenger Transport, A...	„	—	4½	124½	–½	3 12 4
Do. do. B...	„	—	5	125½	—	3 19 9
Do. do. C...	„	3½	4	96	+1	4 3 4
West Midlands Joint Elec. 1948–68	„	—	5	116½	—	4 5 10
TELEGRAPH AND TELEPHONE.						
American Tel. & Tel.	$100	9	9	192½xd.	+1½	4 13 6
Anglo-Am. Tel. Pref.	Stock	6	6	129½	—	4 12 8
Do. Def.	„	1½	1½	31	—	4 16 9
Cable & Wireless 5½% Pref. ...	„	4½	5½	100½	–½	5 9 6
Do. A. 7½% Ord.	„	Nil	Nil	19	+½	—
Do. B. Ord.	„	Nil	Nil	6	—	—
Globe Tel. & Tel. Ord.	10	3½*	4½*	14	—	3 4 3
Do. Do. Pref.	10	6	6	14½	–½	4 5 0
Great Northern Tel.	10	20	20	47	—	4 5 1
Marconi-Marine	1	10	7½	36/9	—	4 1 8
Oriental Telephone Ord.	1	12*	12*	3⅛	—	3 12 6
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref. ...	5	Nil	Nil	5/9	—	—
Do. do. 2nd Pref.	5	Nil	Nil	5/–	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	21½	—	—
British Electric Traction Df. Ord.	„	5	5	1625xd.	+50	—
Do. do. Pref. Ord.	„	8	8	174½	–3	4 10 2
Brazil Traction	100	—	30 cts.	18⅝	+⅝	—
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	106½	+2	4 14 0
Mexican Light Common	100	Nil	Nil	3½	—	—
Do. 1st Bonds...	$500	5	5	47	—	—
Victoria Falls Ord.	1	20	12	75/–xd.	+2/–	3 4 0
West Riding	1	5	6½	48/9	–⅛	2 13 3
MANUFACTURING COMPANIES.						
Aron Electricity Ord.	1	10	15	3xd.	–⅛	5 0 0
Assoc. Elec. Ord.	1	6	8	52/–	+1/6	3 1 6
Do. Pref.	1	8	8	39/–xd.	—	4 2 0
Babcock & Wilcox	1	8	8	48/9	—	3 5 7
British Aluminium Ord.	1	7½	7½	44/–	+6d.	3 8 4
British Insulated Ord.	1	15	20	6½	—	3 5 0
Brush Ord....	Stock	Nil	Nil	40½	—	—
Callender's	1	15	15	4½	—	3 3 1
Do. 6½% Pref.	1	6½	6½	32/6xd.	+6d.	4 0 0
Crompton Parkinson Ord. ...	5/–	12½	12½	3⅛xd.	–1/–	—
Do. 8% Pref.	1	8	8	2xd.	+6d.	4 0 0
Electric Construction	1	3½	7	42/6	—	3 5 9
Enfield Cable Ord.	1	25	25	5⅛	—	4 10 0
English Electric	1	Nil	Nil	28/6	+2/6	—
Do. Do. Pref.	1	6½	—	26/6xd.	+2/–	—
Ericsson Tel.	5/–	24	20*	55/–	—	1 16 4
Ever Ready	5/–	35	35	30/–	—	5 16 8
Ferranti Pref.	1	7	7	28/9	—	4 17 5
G.E.C. Pref.	1	6½	6½	34/–	—	3 16 4
Do. Ord.	1	10	15	92/–	+1/–	3 5 0
Henleys	1	30	30	8½	—	3 8 6
Do. 4½% Pref.	5	4	4½	5½	—	3 18 3
India-Rubber Pref.	1	5½	5½	23/3	+9d.	4 17 9
Johnson & Phillips	1	7½	10	47/6	—	4 4 0
Lancashire Dynamo	1	5	10	3½	—	2 19 0
Siemens Ord.	1	4	6	35/–	—	3 8 7
Telegraph Construction	£1	Nil	Nil	33/9	–⅛	—

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be numbered and abridged and all subsequent proceedings will be taken.

1935

4590. "Means of propelling road vehicles through electro-magnetic variable transmission." C. J. Gordon. February 13th, 1935. (456891.)

7730. "Oscillation generators known as multivibrators." E. L. C. White. March 12th, 1935. (456840.)

7965. "Electro-magnetic interrupters." P. R. Mallory & Co., Inc. March 14th, 1934. (457034.)

9652. "Consumers' electrical mains and distribution boards." J. Firth. March 28th, 1936. (456892.)

11801. "Liquid-circulating systems containing an electric heater." H. O. Mock, P. G. Caldwell and Caldwell Heater & Battery Charger Patent, Ltd. April 17th, 1935. (456971.)

11802. "Electric heaters for heating by circulation of hot liquids." H. O. Mock, P. G. Caldwell and Caldwell Heater & Battery Charger Patent, Ltd. April 17th, 1935. (456972.)

14180. "Electrical furnaces for the heat treatment of metals." Birmingham Electric Furnaces, Ltd., A. G. Lobley and T. G. Tanner. May 15th, 1935. (457093.)

14249. "Circuit and electron tube for the production of beat frequencies." Vereinigte Glühlampen und Electricitats Akt.-Ges. May 15th, 1934. (457040.)

14479. "Electric water-heaters." R. B. Matthews. May 17th, 1935. (457095.)

14496. "Apparatus for measuring electrical resistance." H. S. Hatfield. May 17th, 1935. (457096.)

14506. "Electric toasting, grilling and like devices." Hot-point Electric Appliance Co., Ltd., and F. W. Leevers. May 17th, 1935. (456901.)

14515. "Electrically operated sliding-weight scales." Deutsche Versuchsanstalt für Luftfahrt E. V. and M. Kramer. May 17th, 1935. (456978.)

14597. "Impulse-repeating arrangements for use in telephone and like systems." Associated Electric Laboratories, Inc. May 19th, 1934. (456981.)

14657. "Scanning potential generators for television." Radio-akt.-Ges. D. S. Loewe. May 31st, 1934. (Addition to 423427.) (457101.)

14684. "Electric cycle-lamp connections." J. Lucas, Ltd., and F. Hamner. May 20th, 1935. (457102.)

14700. "Scale and scale mechanisms in wireless receivers." W. A. Burns. May 20th, 1935. (457091.)

14721. "Radio receivers." Coutts & Co. and S. Johnson (Legal representatives of J. Y. Johnson, decd.) (Philco Radio & Television Corporation). May 20th, 1935. (457109.)

14754. "Connector pins for electrical plug-and-socket connections." C. R. Cook. May 20th, 1935. (457113.)

14816. "Radio receivers." K. H. Kerr and S. B. Smith. May 21st, 1935. (457116.)

14842. "Electrical measuring instruments and relays." Nalder Bros. & Thompson, Ltd., and C. L. Lipman. May 21st, 1935. (456988.)

14870. "Traffic control systems." Automatic Electric Co., Ltd., A. P. B. Renshaw and T. P. Preist. May 21st, 1935. (457121.)

14933. "Combined electrical signalling and telephone systems." Associated Electric Laboratories, Inc. June 15th, 1934. (457125.)

14940. "Luminescent materials for use in electric-discharge lamps." General Electric Co., Ltd., and J. T. Randall. May 22nd, 1935. (457126.)

14943. "Closing apparatus for electric circuit-breakers." A. Reyrolle & Co., Ltd., and A. Allan. May 22nd, 1935. (457127.)

14944. Electric switchgear." A. Reyrolle & Co., Ltd., A. Allan and T. Williams. May 22nd, 1935. (457128.)

14968. "Synchronising systems for television and the like." G. R. Tingley and Baird Television, Ltd. May 22nd, 1935. (457129.)

14993. "Electrical couplings of the plug-pin type." G. E. Crabtree, W. T. Elliott, E. Badham and R. W. Thornton. (Legal representatives of J. A. Crabtree, decd.) May 23rd, 1935. (457130.)

15029. "Voltage regulators." J. Lucas, Ltd., J. A. Laird and C. E. Robinson. May 23rd, 1935. (457131.)

15068. "Television apparatus." Marconi's Wireless Telegraph Co., Ltd. May 23rd, 1934. (457135.)

15167. "Electron-discharge devices." Marconi's Wireless Telegraph Co., Ltd., and E. W. B. Gill. May 24th, 1935. (456991.)

15556. "Thermionic cathodes." General Electric Co., Ltd. (Patent-Treuhand-Ges. für Elektrische Glühlampen). May 28th, 1935. (Addition to 445575.) (456992.)

15863. "Submarine electric cable systems." Electrical Research Products, Inc. June 2nd, 1934. (456993.)

16520. "Thermally operated electric switches." Santon, Ltd., and H. C. Sanders. June 7th, 1935. (457049.)

17319. "Means for lighting electric gas discharge tubes." M. Ibuka. June 15th, 1935. (456915.)

23710. "Radio receivers." Murphy Radio, Ltd., G. B. Baker and G. F. Hawkins. August 23rd, 1935. (456928.)

24010. "Indicating devices for electric switches of the rotary type." Diamond H Switches, Ltd., and C. A. Turner. August 27th, 1935. (457062.)

24933. "Pressure-actuated signalling or controlling device." Callender's Cable & Construction Co., Ltd., J. E. Brigg and J. N. Gibson. September 7th, 1935. (456931.)

26310. "Arc lamps having automatic electrode feeding means." Sperry Gyroscope Co., Inc. November 21st, 1934. (457066.)

28764. "Indirectly heated cathodes for electric-discharge tubes." Naamlooze Vennootschap Philips' Gloeilampen-fabrieken. January 11th, 1935. (457070.)

29207. "Electric cells." Batteries, Ltd., and M. Dybeck. October 23rd, 1935. (457072.)

30378. "Twin-filament electric incandescent lamps." Egyesult Izzolampa es Villa-Mossagi Reszvenytarsasag. November 3rd, 1934. (457074.)

1936

67. "Voltage-regulating arrangements for electrical generators and the like." Siemens & Halske Akt.-Ges. January 19th, 1935. (456947.)

5381. "Electric water-heaters." M. S. Gazelle. February 22nd, 1936. (456953.)

5791. "Mercury-vapour generators." British Thomson-Houston Co., Ltd. February 27th, 1935. (457157.)

6254. "Gettering of evacuated envelopes." Farnsworth Television, Inc. March 13th, 1935. (457159.)

6466. "Electric current interrupters." Mallory Patents Holding Co., Ltd. (P. R. Mallory & Co., Inc.). March 3rd, 1936. (456869.)

11095. "Electric-discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. July 5th, 1935. (457166.)

13801. "Telegraph, signalling and like selective systems and apparatus." V. Sims. May 16th, 1935. (Divided out of 14317/35.) (457170.)

14414. "Electrically driven safety razors." A. Konski. May 21st, 1935. (456881.)

14807. "Electric accumulators." C. Baume. May 28th, 1935. (457011.)

15259. "Process and the machine for the electric welding of tubes." D. Sciaky. May 29th, 1935. (457013.)

15557. "Lighting systems, more particularly for projection and kinematographic purposes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 28th, 1935. (457015.)

17112. "Multi-stage thermionic amplifiers." A. C. Price (Siemens & Halske Akt.-Ges.). June 19th, 1936. (457018.)

18014. "Therapeutic apparatus." British Thomson-Houston Co., Ltd. June 29th, 1935. (457175.)

18572. "Circuit arrangements for varying the phase position of the grid potential of controlled electric-discharge devices." Siemens-Schuckertwerke Akt.-Ges. July 4th, 1935. (457021.)

19847. "Electric induction motors." B. Zachariassen. July 19th, 1935. (456887.)

20096. "Navigation-aiding radio systems." Telefunken Ges. für Drahtlose Telegraphie. August 3rd, 1935. (457176.)

21727. "Speed-changing arrangements for three-phase shunt wound electric motors." Siemens-Schuckertwerke Akt.-Ges. November 14th, 1934. (Divided out of 28145/35.) (456890.)

30913. "Electron tubes of the five-grid type." A. F. Burgess. (Vereinigte Glühlampen und Electricitäts Akt.-Ges.) May 15th, 1935. (Divided out of 457040.) (457090.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from December 9th :—

Drilitic. No. 569951. Class 8. Instruments and apparatus for use in telegraphy, television, and the electrical transmission, recording and reproduction of sound.—Dubilier Condenser Co. (1925), Ltd., Ducron Works, Victoria Road, North Acton, W.3.

Kathoscope. No. 570783. Class 8. Radio receiving sets, television apparatus, and parts thereof.—Kolster-Brandes, Ltd., Cray Works, Sidcup, Kent.

Acmeon. No. 570814. Class 8. Signs illuminated by means of light reflecting surfaces or by internal artificial light.—Acme Showcard & Sign Co., Ltd., Paragon Works, Green Street, Brimsdown, Middlesex.

Nixin. No. 572020. Class 13. Electric lighting fittings.—Walter Jones, Ltd., Africa House, Kingsway, W.C.2.

Everite. No. 570970. Class 50. Knobs and levers, bases for bells, electric fixtures, cases for wireless apparatus, &c., all being goods made of synthetic resin.—Evered & Co., Ltd., Surrey Works, Lewisham Road, Smethwick, Staffs.

Locating Fish by Electricity

Many important fishery areas, in particular the North Sea, are yielding smaller supplies than were obtained in former years, and the discovery of new grounds as well as the immediate location of fish shoals is becoming of paramount importance. Fishery experts in Norway have been definitely successful in their attempts to detect fish in depths of from 100 to 200 ft. with echo sounders. Immediately the presence of the fish was discovered the Norwegian purse seine net fleet succeeded in landing heavy catches. Scottish West Coast fishermen, too, have amply tested the efficiency of this type of instrument in spotting herring, particularly when they were operated in sheltered, placid waters. Fish were directly located when there were no visible signs of their presence, such as sea birds, air bubbles or an oily sea surface, the presence of whales or basking sharks. German trawlers are also said to be obtaining good results. The echo-sounders emit electric waves that, in the ordinary course, reach the sea-bed and return to their source. When they have completed their journey they record on a chart an indication as to whether the sea-bottom is rocky or sandy and as to the depth of water. If there should happen to be an intervening object an "echogram" of this is also obtained. It has been found possible to detect shoals of fish, herring, and cod, particularly, because there is sufficient air in their bodies to cause a reflective action on the travelling electric waves, thereby enabling "echograms" of their presence to be recorded. Even the size of cod in particular shoals has been measured with accuracy. It is anticipated that in a comparatively short time further research will bring the echo-sounding apparatus to the forefront as a practical aid to the fisheries.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Abergele.—Extensions to County school (£20,000); secretary.

Acocks Green (WARWICKSHIRE).—Laundry near Clay Lane for the Birmingham Co-operative Society, Ltd. (£60,000), with electrical work; C.W.S. architects' department, 1, Balloon Street, Manchester.

Aldridge.—Factory, Middlemore Lane, for Johnsons (Aldridge), Ltd.; T. G. Elton, builder, Bloxwich, Walsall.

Barnes.—Flats (146), at the junction of Chertsey Arterial Road and Lower Richmond Road; F. H. Ayling, Ltd., builders.

Barnstaple.—Regal Cinema, the Strand; Orphoot & Whiting, architects, High Street, Bideford.

Barrow-in-Furness.—Houses (109), Davy Street; A. Ingham. Houses (86), Hawcoat Lane; J. Parkinson & Sons, Ltd.

Bebington.—Houses (160), Bolton Road East, for Graylands Estates, Ltd.

Becontree.—Factory for Crollie & Sons, Ltd.; Henry Butcher & Co., architects, 63, Chancery Lane, London, W.C.2.

Blackpool.—Houses (40), Lakeway; J. Gregson & Son. Houses (47), Milford Avenue; R. Fielding & Son. Rebuilding stores, Chapel Street; Blackpool Co-operative Society, Ltd.

Blaydon-on-Tyne.—Sports stadium for the Tyneside Stadium, Ltd. (£100,000); Arthur & Kirkup, architects, 13, Swinburne Street, Gateshead-on-Tyne.

Brighton.—Houses (46), Redhill Drive; Dyke Road Estate, Ltd. Houses (30), Wilmington Way; C. W. Parkes. Dwellings, Nelson Place (£26,000); borough engineer. Rebuilding, 200, Western Road, and Imperial Hall for Marks & Spencer, Ltd. (£23,410); Bovis, Ltd.

Bristol.—Cinema, Linden Road, Northumberland estate; A. French, architect, 3, Unity Street.

Buckhaven.—Extensions to Cameron Hospital (£50,000); Fife Public Health Committee.

Bury.—Factory, for L. Weidberg, Manchester.

Buxton.—School, Silverlands (£26,214), for E.C.

Cheadle (CHESHIRE).—Cinema, at the junction of Gatley Road and Old Hall Road, Gatley; Teasdale & Sunter, architects, St. Mary's Parsonage, Manchester.

Chichester.—Hospital (£106,421); Anglo-Scottish Construction, Ltd.

Coseley.—Cinema, Wolverhampton Road; R. Satchwell, architect, 6, New Street, Birmingham.

Coventry.—Factory, Canley, for the Coventry Aero Engines & Components, Ltd. Hippodrome, Hales Street (£80,000) with electrical work; Harris & Sons, builders, Cope Street. Stores and showrooms, Warwick Lane, for Messrs. Holbrooks, Hertford Street (£20,000), with electrical work; C. Redgrave & Sons, architects, Earl Street.

Cowie (STIRLINGSHIRE).—Houses (70); T. J. Irvine, 69, Vicar Street, Falkirk.

Dagenham.—Public baths (£26,233); Fairhead & Sons, Ltd., builders.

Derby.—Nurses' school and clinic, for Borough E.C.; C. H. Aslin, borough architect, Gower Street.

Dudley.—Houses (50), Harcourt estate, Bars Road, Old Hill; T. Mucklow, builder, Market Chambers, Blackheath. Block of offices and shops, Tower Street (£15,000) with electrical work; A. J. Crump & Sons, builders, Aston Road.

Dukinfield (CHESHIRE).—Houses (76) and flats, Birch Lane; borough surveyor.

Eastbourne.—Houses (51), Freeman Avenue; Davis Estates, Ltd. Police station (£26,909); Eames & Calverley. Transport offices, Churchdale Road; borough engineer.

Erdington.—Buildings, Court Lane; Kemp & Sons, builders, Clifton Road, Birmingham.

Fraserburgh.—Houses (22), School Street; Ferguson & Co., Frithside Street.

Gateshead-on-Tyne.—Houses, Hill Crest estate; W. Leech, builder, 2, Clayton Street, Newcastle-on-Tyne.

Glasgow.—Printing works, Oakbank Street, and school and workshops, Larkfield Bus garage (£70,000); city engineer. Rebuilding factory; Lynn Proofing Co., Ltd., 356, Amulree Street.

Gloucestershire.—Domestic college, Gloucester, for County E.C.; director of education, Gloucester.

Golborne (LANCASHIRE).—Houses (50); J. G. Holland & Son, builders. Houses (56); Clough & Gaskell, builders.

Hastings.—Houses (68), Oakleigh Park estate; T. E. Relfe.

Heanor.—Houses (100), Highfield estate; E. Goddard, architect.

Ipswich.—Theatre; R. Woodhouse Beales, architect.

Irish Free State.—(CARRICK-ON-SHANNON, Co. LEITRIM).—Houses (82), for County Board of Health (£26,730); Kilcawley, Maloney & Taylor, Collooney. (DUBLIN).—Dwellings, North Crumlin area, and flats, Railway Street and Marrowbone Lane, for Corporation. Dwellings and shops, Townsend Street (£88,232); Meagher & Hayes. Flats (111), Poplar Row (£49,358); C. S. Downey. (DUNGARVAN, Co. WATERFORD).—Houses (£42,124); M. Whelan, Dungarvan. (PORT LAOIGHISE).—Houses (£31,981); J. Fitzpatrick.

Kendal.—Houses (24); borough surveyor.

Kenley (SURREY).—Engineering factory, Godstone Road; Koreet Depth Gauge Co., Ltd.

Kilmarnock.—Cinema; T. Shankland, architect, Stewartlea, South Hamilton Street.

Lanarkshire.—Offices, for Hamilton C.C. (£39,000); architect, county council, Hamilton.

Litherland.—Council offices, including public hall, Sefton Road (£20,000); G. de C. Fraser, architect.

London.—(CLERKENWELL).—Factory and warehouse, for A. J. Pratt & Sons, Ltd., 7, Woodbridge Street, E.C.1. (KENNINGTON).—Tenements (214), Park estate (£30,720); Unit Construction Co., Ltd. (PADDINGTON).—Flats, Dudley Street area (£30,780); borough engineer. (POPLAR).—Flats (264), Bow Road (£165,000); L.C.C. architect. (SOUTHWARK).—Flats, Comus Place (£34,882); A. T. Rowley, Ltd. (STEPNEY).—Houses, Malay Street (£77,500); L.C.C. architect. Central depôt, Regents Canal site (£39,262); borough engineer.

Lymington.—Houses (22); borough surveyor.

Melton Mowbray.—Houses (24); R.D.C. surveyor, Nottingham Street.

Middlesbrough. — Rebuilding, Fleetham Street school (£20,000), with electrical work, for E.C.; Peel, Ltd., builders, East Mill works.

Newcastle-under-Lyme.—Houses (90), Sparrowfield estate, Maybank; Phillips Bros. (Silverdale), Ltd., May Street, Silverdale.

Northumberland.—Schools, Ashington, for C.C. (£52,000); W. W. Tasker, county architect, County Hall, Newcastle-on-Tyne.

Norwich.—Schools, Lakenham & Earlham, for E.C.

Pateley Bridge (YORKSHIRE).—Re-erection of the new York Mill, Summerbridge, for Thomas Hill & Sons, Ltd.

Ramsgate.—Houses (89), West Dumpton; H. Cro, builder, Minster-in-Thanet.

Retford.—School, Hallcroft (£25,000), with electrical work, for E.C.; Richmond & Sons, builders, Retford.

Rochdale.—Houses (200), Canal Street, Castleton; Greatorex (Builders), Ltd., Castleton.

Rubery.—Cinema and shops for W. T. Hodge, Northfield.

Rye.—Houses (56); A. G. J. Corner, borough surveyor, 107, High Street.

St. Annes-on-Sea.—Hotel, Beach site; Halstead Best, architect.

Scarborough.—Houses (98), the Barrowcliff estate; H. V. Overfield, borough engineer. Houses (24), near Seamer Road; F. W. Plaxton, builder, Marlborough Street. Cinema, Northstead; Burkinshaw & Woodcock, York Place, Scarborough.

Shermanbury (SUSSEX).—Development of Hanger Wood estate; W. J. Pain.

Slamannan (STIRLINGSHIRE).—Houses (50); A. H. Muir, 2, Manor Street, Falkirk.

Solihull.—Houses (33), Tiddington Road; A. Ford, builder, Newborough Road.

Stockton-on-Tees.—Houses (58), Hermitage Road; Moorhouse & Barker, Ltd., builders, 64, Thornaby Road, Thornaby-on-Tees.

Stoke-on-Trent.—Houses (42), Hanley Road, Sneyd Green, for the North Staffordshire Co-operative Dairy, Ltd.; Edmund Jackson, Ltd., builders, Edward Street.

Sunderland.—Houses (492), Hylton estate, for the North-Eastern Housing Association, Ltd.; W. Welford, builder, "Hawthorns," Whitburn, South Shields. Nurses' home at the Municipal Hospital; Bell Brothers, builders, South Back Cleveland Road.

Sutherland.—Houses (22), with electrical work, for C.C.; E. W. Brannen, architect, Dornoch.

Swansea.—Cinema, Townhill Road; Townhill Cinema Co., Ltd. Cinema and shops, Gower Road; Max Corne.

Taunton.—Showrooms and offices, for the electricity department; H. S. W. Stone, architect, Lloyd's Bank Chambers, 7, Fore Street.

Thorne.—Houses (100), North Eastern Road; H. Plews, R.D.C. surveyor.

Torquay.—Houses (65), Maidencombe; Maidencombe Estates, Ltd. Houses (300), Watcombe; borough engineer. Extensions to Torbay Hospital (£15,000); governors.

Tynemouth.—Houses (20) and bungalows, Glanton Road; F. R. N. Haswell & Son. Houses (248), Ridges estate; borough engineer.

Tyseley (BIRMINGHAM).—Factory, King's Road, for the Co-operative Wholesale Society, Ltd. (£50,000), with electrical work; C.W.S. architects' department, 1, Balloon Street, Manchester.

Walsall.—Houses (178), Harden estate (£57,000); J. Wistance, Ltd. Extensions to Barr mental colony (£50,000); borough engineer.

Wednesbury.—Houses (128), Hydes Road, for J. Brookes & Co. Houses (288); A. Booth, borough surveyor.

West Hartlepool.—Houses (21), Kendal Road; Heslop and Johnson, architects, Church Square.

Widnes.—Houses (120), near Warrington Road; T. Wright & Son, Water Street, Thornton.

Winsford (CHESHIRE).—Houses (62); U.D.C. surveyor.

Woking.—Houses (34), Woodlands Avenue, Sheerwater estate, for E. Thomas & Co.

Wolverhampton.—Houses (128), Three Tuns estate (£47,784), with electrical work; J. McClean (Builders), Ltd., builders, Coven. Houses, Walsall Street (£25,680), Low Hill estate (£34,462), and Guy Avenue (£37,804), with electrical work; A. M. Griffiths & Son, builders, Thomas Street. School, Elston Hall, near Stafford Road; borough engineer.

Worthing.—Houses (24), Angmering; R.D.C. surveyor, 15, Mill Road.

I.E.E. Students' Dance

At the annual dance of the Students' Section of the Institution of Electrical Engineers last Friday at the Imperial Hotel, London, over 160 people were present—more than at any previous similar function. During an interval the dancers heard the broadcast address by the Duke of Windsor. For the success of the evening credit is largely due to Mr. L. E. Maddams, the entertainments secretary.